# Electrical Contracting

THE MAGAZINE OF ELECTRICAL CONSTRUCTION AND MAINTENANCE

ECEMBER
1942

w price regulations for con-
uction set ceiling formulas for
t plus, negotiated and contract
rk. See Page 21.

Electric controls are vital to
r production. Skillful, planned
e will keep them on the job.
e "Maintaining Industrial Con-
l". Page 27.

NDUSTRIAL ELECTRIFICATION SECTION—Pages 51-66.

I'M NEARLY THROUGH ALREADY—YOU KNOW IT TAKES ONLY A JIFFY TO PLUG IN THE BREAKER
YES, THAT SURE IS A NEAT ARRANGEMENT—YOU HAVEN'T HELD US UP AT ALL
GENERAL ELECTRIC
AIR CIRCUIT BREAKER

# Here's Why This New Removable Breaker Is So Easy to Install

HERE'S a breaker that sets a new record for quick installation. With the case bolted in place, it's easy to connect the cables—there's plenty of room to work. And then it takes but a moment to plug in the breaker unit, which has contacts that readily engage those in the case.

This new removable breaker saves valuable time when in service, too. In fact, it's called the *3-minute breaker*, because, with it, you can re-establish service after temporary faults in less than one minute; inspect the breaker in safety—away from live parts—in less than *two* minutes; and where load conditions have changed, you can interchange breaker units in less than *three* minutes.

Install these new AE-1 breaker units in lighting, power, and motor circuits. They will protect both the circuit wiring and the apparatus connected to the circuit. They will guard against the prolonged delays and the damage often caused when less adequate protective devices are subjected to severe short circuits.

A new illustrated booklet (GEA-3600) tells how and shows where to use these breakers. For a copy, write the G-E office near you, or address *General Electric Co., Schenectady, N. Y.*

***THE BREAKER WITH THE DISCONNECT FEATURE***

**GENERAL ELECTRIC**

860-24-7500

# "A FIRST CLASS INSTALLATION", *say electricians*

## (*and they also say,* "SO EASY TO PUT IN")

Arc-quenching construction in 2, 3 and 4 Pole, 30, 60 and 100 Ampere Safety Switches.

**SKETCHED above is the switch block from a Murray Single Throw, Fusible, Type D, Safety Switch. In the circle is the outstanding feature — the double break blade and arc quenching chamber.**

**Each blade is provided with a double break — the arc is broken into two parts. The burning is greatly reduced by this feature. Whatever arc is formed at each of the two breaks is drawn into a narrow slot in the mounting base where it is lengthened-out and cooled — the effects co-acting to quench the arc almost instantly.**

**This arc-quenching construction coupled with those Murray Switch characteristics as ample wiring room, properly placed knockouts, good-looking cabinets, assure the electrician the satisfaction that comes from a first-class installation. Metropolitan Device Corporation, Brooklyn, New York.**

*Write for the facts — no obligation!*

# Murray

SAFETY SWITCHES

**THERE ARE MURRAY JOBBERS EVERYWHERE**

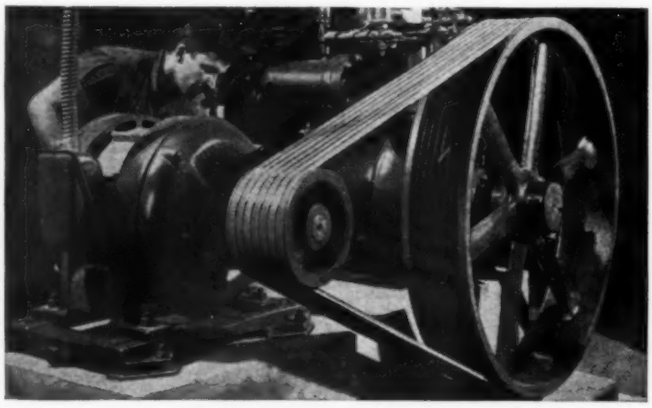
*Keep On*

BUYING WAR BONDS AND STAMPS


ELECTRICAL CONTRACTING. Published monthly, price 25 cents a copy, Vol. 41, No. 12. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Electrical Contracting, 330 West 42nd Street, New York, N. Y. Subscription Rates —U. S. A., and Latin-American Republics, $2.00 a year, $3.00 for two years, $4.00 for three years. Canada $2.50 a year, $4.00 for two years, $5.00 for three years. Great Britain and British Possessions 18 shillings for one year, 36 shillings for three years. All other countries $3.00 a year; $6.00 for three years. Entered as second-class matter August 29, 1936, at Post Office at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. Copyright 1942 by McGraw-Hill Publishing Company. Cable address: "McGrawhill, New York." Member of A. B. P. Member A. B. C.

# It's Time to Look at Motor

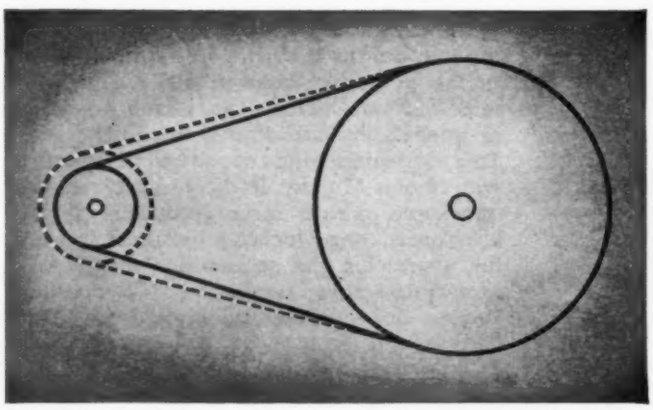
## ➔*You Can Save with High-Speed Instead of*



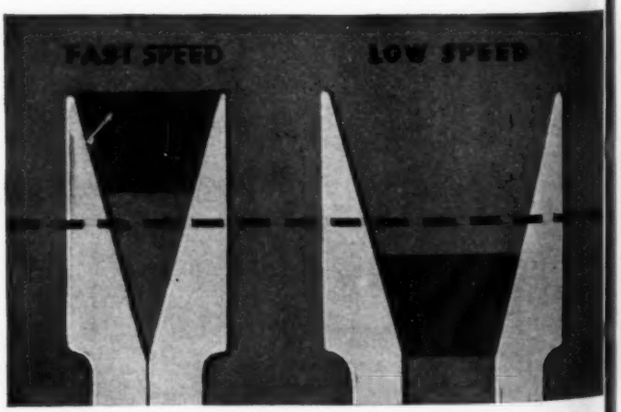
**1.** In most applications, an 1800 rpm motor with Texrope Drive will ably do the job of a lower-speed, direct-connected motor . . . *and* give you *exactly* the speed you want — *at lower cost!*

**2.** When you buy an 1800 rpm instead of 450 rpm 15 hp squirrel-cage motor, for example, 600 lb of critical materials are saved. And *you* save well over $200—with the drive figured in! This saving is typical.

## ➔*You Can Save with Single-Speed Instead of*



**1.** Infrequently needed speed changes can be had by changing from one size motor sheave to another. By juggling *complete* drives, speeds can be changed over the full range — from 1:1 to 7:1.

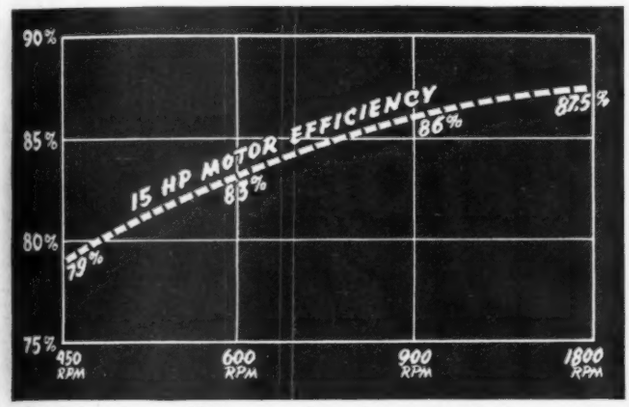



**2.** With the Allis-Chalmers Vari-Pitch Sheave, you can increase or decrease speed by adjusting sheave diameter, as above. Within limits, an unbroken series of speeds can be obtained.

# Take a Fresh Buying!

**WAR FORCES HIGHER EFFICIENCIES...**

## *Low-Speed Motors...*




**3.** Note that efficiency rises from 79% for a 450 rpm motor to 87.5% for a 1800 rpm motor. Comparing power consumption, the 1800 rpm motor saves you over 30 kw/24 hr. day.

## *Multi-Speed Motors...*

**3.** Allis-Chalmers Vari-Pitch Speed Changer gives you infinite changes at the turn of a wheel — within 3.75 to 1. It's the most compact, flexible variable-speed transmission available.

**It was good business in peacetime to use — as widely as possible — high-speed motors with Allis-Chalmers Texrope Drives...and single-speed motors with Allis-Chalmers Vari-Pitch Sheaves and Speed-Changers. And it's clearer every day that those material and money-saving practices are *vital* practices in time of war!**

TODAY the whole picture of buying and applying motors has changed. Note at the left how much you can save for your country *and yourself* with high and single-speed motors made flexible by Texrope Drives.

As America's only builder of both electric motors and V-belt drives,* Allis-Chalmers has long advocated the proper combining of motor and V-belt drive.

And today you benefit from Allis-Chalmers' vast, pioneering experience in this field when you ask for and get the *right* combination of Lo-Maintenance Motor and Texrope Drive! Call your nearby district office. Or write ALLIS-CHALMERS MFG. CO. MILWAUKEE, WISCONSIN.

A 1560

*Allis-Chalmers *originated* the Multiple V-Belt Drive and Vari-Pitch Sheaves.

ALLIS-CHALMERS A-C MILWAUKEE

WE WORK FOR VICTORY — WE PLAN FOR PEACE

# Minute men to arouse sleeping Scrap.....

Steel salesmen, along with the salesmen of all other industries, are the Minute Men of 1943. Their task is to arouse dormant scrap—in your plant, in every shop they can reach.

Be on the alert for this modern Minute Man's urgent call. His job is threefold:

1. To remind you of the objectives of the WPB Dormant Scrap Drive and enlist your scrap.
2. To help you determine what may be considered dormant scrap.
3. To help you start your dormant scrap on its way to hungry steel furnaces.

So long as an enemy is in the field, scrap need will be critical. The Minute Men are pledged to help you keep it rolling for the duration.

26-23E

THIS ADVERTISEMENT SPONSORED BY

THE YOUNGSTOWN SHEET AND TUBE CO.

*Youngstown, Ohio*

# Don't

# WASTE MAN-HOURS

## AND CRITICAL MATERIAL

## Building Special Enclosures

**...there's a STANDARD G-E combination starter to meet every operating condition**

**CORROSION-RESISTANT**

These starters (Type 8) are made in two forms—one for corrosive atmospheres and one for hazardous locations. All their arcing parts and terminals (for use in hazardous locations) are at least six inches under oil.

**GENERAL-PURPOSE**

The Type 1 enclosure is suitable for general-purpose, indoor applications where atmospheric conditions are normal.

**DUST-TIGHT**

The Type 5 enclosure is for use in steel mills, cement mills, and other locations where the dust content of the atmosphere is so heavy as to make a dust-tight case desirable. The cases are of heavy sheet metal, equipped with heavy gaskets, clamping bolts, and wing nuts.

**FOR HAZARDOUS LOCATIONS**

The Type 7 case for Class 1, Group D, locations is made of cast, high-strength alloy. These starters can withstand internal explosions. The flanges, which are securely bolted on all sides, are ground to tolerances that will not permit the escape of hot gases.

**WATERTIGHT**

The Type 4 case is suitable for outdoor use, and for installations in damp places indoors, such as in dairies and breweries.

The Navy "E", for Excellence, has been awarded to 92,700 General Electric employees in six plants manufacturing naval equipment.

# *Order* STANDARDS *to save time and material*

NEVER ENOUGH production time—scarce material urgently needed! Both far too valuable to be spent in building unnecessary control rooms and special enclosures.

But delivered-ready-to-install control isn't all that the General Electric line of standard combination starters offers you.

These starters combine two devices—a fused motor-circuit switch and a magnetic starter—in one compact unit. This saves you one complete mounting job. They come to you completely wired and ready to install—saving all the time and material needed to wire up two individually mounted controls.

If you wish, our local sales engineers will help you select the proper starter for your job from this standard line of G-E combinations—for a-c motors up to 200 hp. *General Electric, Schenectady, N. Y.*

GENERAL ELECTRIC

A STORY THAT

# Voltage with a Vengeanc

BACK of almost every machine that is humming in America's war plants is the unseen powerful force that makes it hum ... ELECTRICITY!

But how did we get all of this power, so suddenly and so quickly? For America's power demands pyramided almost overnight ... and there wasn't always enough extra generating capacity lying around idle in the spots where it was needed. There's where the American power companies performed a miracle, throwing into the job their ready-and-waiting plans of inter-connection of systems, and expansion. And presto, there was the voltage ... with a vengeance.

But existing power transmission lines could not hope to carry the additional load. Here again, additional wires and cables were reared to the skies across the land, reaching war plants in the widely scattered areas, many of them remotely located. For every war-plant machine, when installed, must find its powe and waiting, wired in and ready for use.

It speaks well for the teamwork of the A Electrical Industry that each machine DID voltage waiting ... with a vengeance.

It's the American way of doing things. Tod Washington analyzed the needs, guided an nated the tremendous enthusiasm which the put into the task. Much of the credit goes t men in the ranks, the skilled labor, the electri contractors ... for today the working man's d as much a badge of all-out patriotic effort a form of the soldier.

In a war of armament production, it is po plays an all-important part. And Americ power ... electrical power ... "voltage with a v

GENERAL CABLE CORPORATI

*Manufacturing Plants from Coast to Coast*

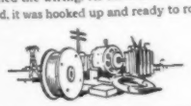
ARMY

# ...NEEDED THIS TELLING...

## *The Electrical Industry Will Keep the War Plants Powered to Produce*

Its Electrical Contractors, and the skilled Electricians in Industry's employ, will tackle the electrical maintenance job with the same patriotic eagerness they put into getting the plants built.

Before the walls were complete or the roofs put on the new plants, the electrical workers had swarmed on the jobs, run in the feeder cables, installed the wiring. As soon as machinery arrived, it was hooked up and ready to roll.



Electricians did their bit—with a vengeance. So did the Electrical Supply Houses, everywhere.

☆ ☆ ☆

Suppose 'twas Tenakee, Arizona. Right there was an Electrical Supply House and its warehouse stocks of a thousand electrical items. 'Twas just like having a hundred or two electrical manufacturers just around the corner. And the electrical contractor who installed the material has just as complete service in Tenakee as he would in Philadelphia, Cleveland or anywhere else.

☆ ☆ ☆

And so it will be in the continuing job of keeping the plants going. Any plant, anywhere, is just a few miles from an established Electrical Wholesaler. It is from his stocks that emergency needs will be filled, and the machinery kept busy at its vital war tasks.

*This Advertisement* **reproduced herewith speaks for itself. It is published on behalf of the Industry of which you and we both are a part. It is one of a series by which General Cable hopes to bring home to the public a better realization of the important service the Electrical Contractor is rendering in times like these.**

☆

Scheduled appearances include the Washington Post, New York Times, Chicago News, San Francisco Chronicle, Los Angeles Times, St. Louis Post Dispatch, Dallas News, Saturday Evening Post, Time Magazine and Business Week.

*General Cable Corporation Sales Offices are located at Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Houston, Kansas City (Mo.), Los Angeles, New York, Philadelphia, Pittsburgh, Rome (N.Y.), St. Louis, San Francisco, Seattle, Washington (D. C.)*

# EXTEND

## THE EFFECTIVENESS OF PROTECTIVE FLOODLIGHTING WITH

## SANGAMO TIME-SWITCHES

FULL automatic control, as provided by Sangamo Time-Switches, extends the effectiveness of protective floodlighting. It adds to the protection of floodlighted factory yards, building approaches, railroad sidings, storage yards, and other vital property serving in war production, by eliminating the factor of human forgetfulness. A Sangamo Astronomic Dial Switch, especially, adds convenience, because the frequent resetting for the changing length of daylight is unnecessary. This switch does this automatically—every day—in exact accordance with suntime. A complete line, including astronomic dial, automatic carry-over, and outdoor time-switches, permits the selection of the exact form of Sangamo Time-Switch for any specific requirement.

### DURING BLACKOUTS

DURING any current interruption, as for instance when a master-switch is pulled for a temporary black-out, Form VSWZ Astronomic Dial Time-Switch will continue to run for ten hours. An automatic carry-over feature provides for clock-spring operation when the current is off. The clock-spring rewinds automatically when the current is restored, and the time-switch resumes its normal synchronous operation.

**SANGAMO ELECTRIC COMPANY** SPRINGFIELD ILLINOIS

# Use the NEW G-E Forlamp ballast for fluorescent-lighting installations

THIS new 100-watt, 265-volt ballast—which operates four 100-watt fluorescent lamps—requires 48% less copper, 47% less iron and steel, and 50% less aluminum than two Tulamp ballasts of the same rating—previously the most economical hookup available.

**BALLAST COST IS CUT IN HALF**

One Forlamp 100-watt ballast does the work of two Tulamp 100-watt ballasts, yet costs the same as *one* Tulamp ballast.

**SAVING IN POWER**

Electrical losses of the Forlamp ballast are 46% less than the losses of two Tulamp ballasts of the same rating. You can operate four 100-watt lamps at rated lumens of light output with 8% less power consumption.

In one large bomber-plant installation this has meant the release of 396 kilowatts of power for other uses.

**COPPER SAVINGS, TOO**

The new Forlamp ballast operates within a voltage range of 250 to 280 volts on power supplied by 265/460Y-volt circuits. On these circuits only one-fourth to one-third as much copper is required to carry a given amount of power as is required to carry the same amount of power at 115 volts.

Most new war plants—particularly those with load-center distribution systems—have circuits carrying power at the necessary voltages for the operation of the Forlamp ballast. Plants converting to war production can often provide these voltages on their lighting circuits.

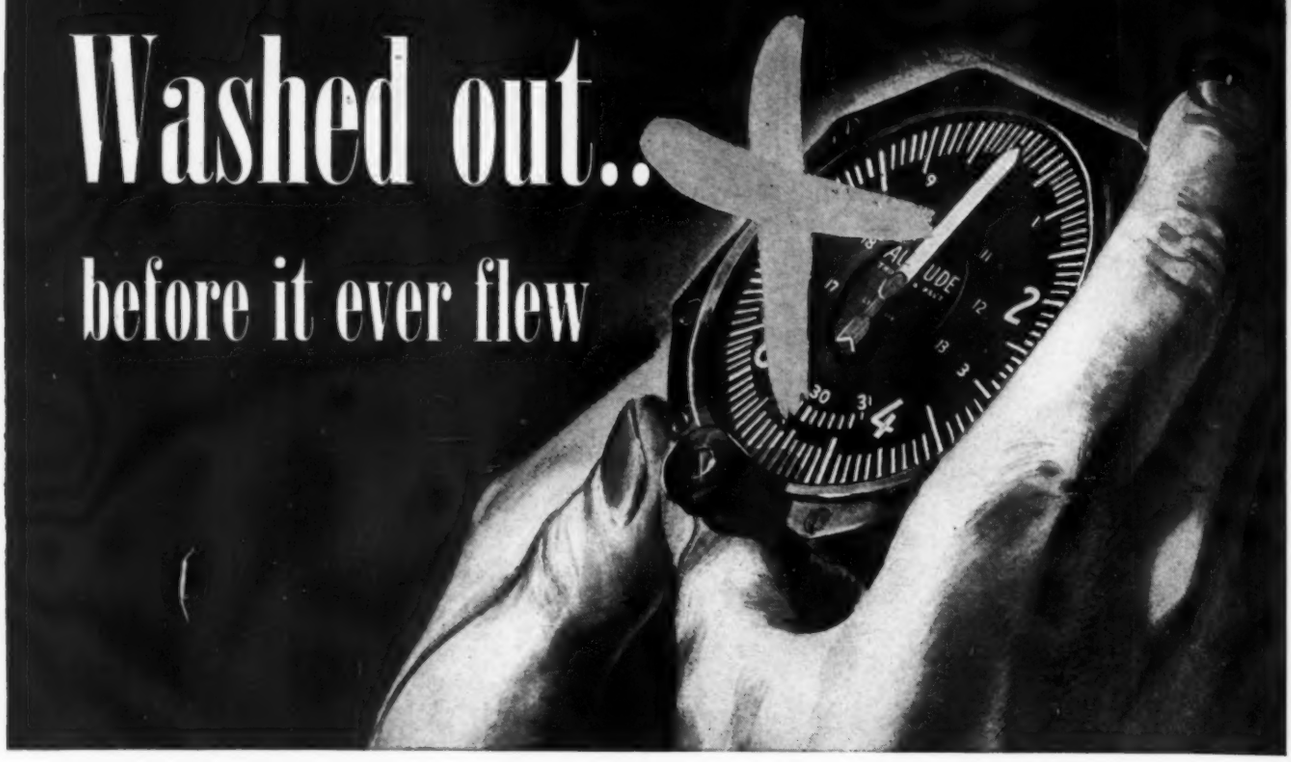
**BULLETIN GEA-3293D** contains information on the complete line of G-E ballasts for all MAZDA F lamps from 4 to 100 watts. *General Electric Co., Schenectady, N. Y.*

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment

**GENERAL ELECTRIC**

408-10-5205

# Washed out.. before it ever flew



● It's a rejected aircraft instrument — a tiny monument to wasted man-hours and lost material. Somewhere along the line a worker's eyes were strained or tired toward the end of the shift. And an important piece of work failed to come up to exacting precision specifications.

You can help to eliminate such costly — and often needless — mistakes.

Prime contractors and subcontractors in your own territory — under pressure to attain production goals — may have overlooked one important item in their plant programs. Many of them stand in need of the cool, glare-free, shadowless illumination of fluorescent lighting.

It is insurance against the eyestrain and fatigue that forfeits rejects to the Axis. It steps up production.

Fluorescent installations, in most instances, more than double lumen output on existing wiring. Since improved lighting efficiency speeds top-quality production, most plants engaged in war work qualify for priorities on Sylvania fluorescent lighting.

Ever since the first commercial and industrial use of fluorescent lighting, Sylvania's leadership has been based on its progressive technical developments. These continuous advances have produced Sylvania Lamps which today deliver these results:

More light — more lumens per watt. Longer life. More uniform coloring. Finer coating — smoother texture.

Survey the war plants in your area. Show their officials how fluorescent lighting can speed production. Serve your country by helping them get fluorescent. If you wish, our representative will gladly assist you in securing the necessary priority rating. Write Department EC-12.

**YOU CAN SEE THE EXTRA QUALITY**

Look at the smooth, even coating of Sylvania Fluorescent Lamps. It is visible assurance of top performance—of Sylvania's high quality. This strict control of quality gives you maximum lumens per watt, uniform light-color, long lamp life.

**SYLVANIA**

**ELECTRIC PRODUCTS INC.**

formerly Hygrade Sylvania Corporation
Salem, Mass.

*Incandescent Lamps, Fluorescent Lamps, Fixtures and Accessories, Radio Tubes, Electronic Devices.*

# LET'S GIVE TIME A RATING

**Can we give it less than an "AAA"? After all, like scarce materials, there is just so much time to go around, and no more.**

**Manufacturing time, 24 hours of it each day, is the only time we have to spend here at The Thomas & Betts Company. Our T & B Distributors back up our War Production with 24-hour service, thus saving time for us and for the users of our products.**

**This T & B Distributor service includes locating sources of strategic and suitable substitute materials for customers. Providing warehousing. Extending credit. Counseling customers how to operate under the Priorities system. Giving personal attention to unusual War Production problems.**

**In the experience of this company the time-and-money-saving services of the Electrical Wholesaler are indispensable to the War Program.**

T&B

## THE THOMAS & BETTS CO.

INCORPORATED

MANUFACTURERS OF ELECTRICAL FITTINGS SINCE 1899

ELIZABETH, NEW JERSEY

# Only 6 Ounces of Steel Per Foot

# THE NEW SPERO DUR-O-LITE REFLECTOR AND RACEWAY OF NON-METALLIC MATERIAL

## 90% Less Critical Steel Makes It Possible For You To Keep On Selling Fluorescent Lights To Help Speed The War Effort

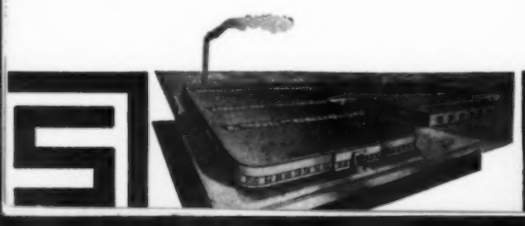
Looking beyond the new Limitation Order L78 which prohibits the use of steel for fluorescent reflectors, SPERO offers a new fixture which *anticipates future restrictions* by also eliminating steel from the raceway . . . This development is made possible by the use of three-ply synthetic-resin bonded and formed plywood—which has passed the most rigorous laboratory tests, including the Underwriters heat tests. It takes the same high-gloss enamel finish (reflection factor 88%) and presents no difference in appearance from steel fixtures.

Designed for industrial installation, Spero DUR-O-LITE meets the Bureau of Standards specifications for fluorescent reflectors. Models are available for two or three 40 watt tubes. They may be equipped with standard ballast and starters, or with the new Spero development INSTA-LITE which combines functions of ballast and starter, and provides instantaneous illumination without flicker or delay. By eliminating the starter switch, INSTA-LITE materially reduces maintenance cost, since starters are the most frequent cause of fluorescent light failures.

Don't pass up profitable War Plant installations. Get the the facts about the new DUR-O-LITE today. SPERO offers you the most modern line of industrial fluorescent and incandescent fixtures . . . Distributed only through electrical wholesalers.

**With NEW INSTA-LITE**
*gives you Instant Starting and Instant Lighting with NO starting switch*

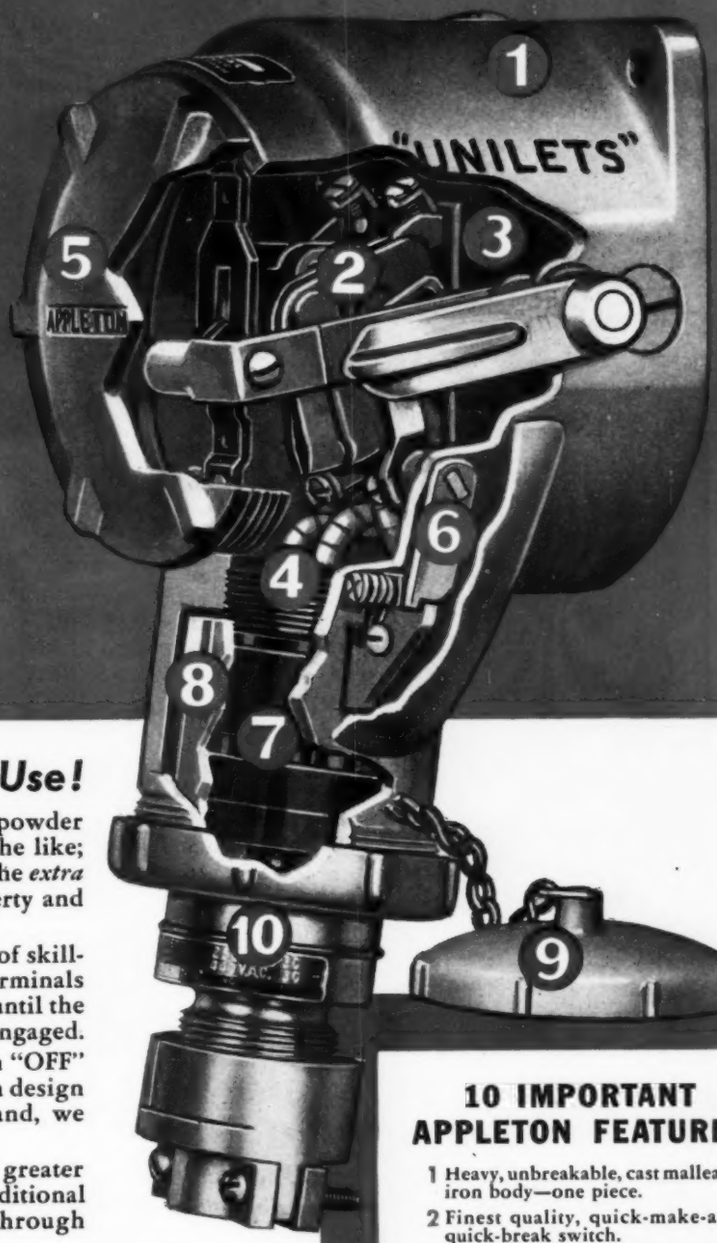
*. . . 5 LINES of Products from one dependable source*



THE SPERO ELECTRIC CORPORATION
18222 LANKEN AVE. ★ CLEVELAND, O

# Rugged as a Battleship

## Appleton "FSQX" Explosion-Proof Receptacle Offers ADDED PROTECTION for Hazardous Locations




### No Hot Terminals When NOT In Use!

Where danger lurks, due to use of portable equipment in powder mills, chemical plants, oil refineries, rubber plants and the like; Appleton "FSQX" Explosion-Proof Receptacles provide the *extra margin of safety* necessary to avoid disaster to life, property and vital war production facilities.

A simple sturdy, positive, interlocking device—typical of skillful Appleton engineering design—makes exposed hot terminals impossible. Switch can not be thrown to "ON" position until the polarized plug is completely inserted and all terminals fully engaged.

Likewise, plug can not be withdrawn until switch is in "OFF" position! "FSQX" Receptacles are foolproof—the safest in design and construction that Appleton knows how to build, and, we believe, the best equipment of their kind in America.

Bodies are heavy, cast, malleable iron; in one piece for greater strength and safety, and are practically unbreakable. Additional terminal connected to shell forms positive ground through entire conduit system.

Don't take chances with hazardous locations, particularly in war production plants! Specify "APPLETON" Explosion-Proof equipment throughout—it's "STANDARD FOR BETTER WIRING!"

*Sold Through Wholesalers*

**APPLETON ELECTRIC COMPANY**

1704 WELLINGTON AVENUE • CHICAGO, ILLINOIS

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*Resident Representatives:* Baltimore, Boston, Cincinnati, Dallas, Denver, Kansas City, Milwaukee, New Haven, New Orleans, Philadelphia, Seattle.

### 10 IMPORTANT APPLETON FEATURES

1 Heavy, unbreakable, cast malleable iron body—one piece.

2 Finest quality, quick-make-and-quick-break switch.

3 More than ample clearance between live parts of switch and body—roomy, easy to wire.

4 Switch easily accessible—wiring heavily bead-insulated—terminals soldered.

5 Deep-threaded aluminum cover, locked in place by special, tamper-proof set-screw.

6 Simple, sturdy interlocking device for positive safety—completely housed, won't jam.

7 All contacts, including ground, *must be fully engaged* in order to operate switch.

8 Polarized.

9 Tight threaded cover, with rubber gasket.

10 "FP" Plug with cable grip and brass *weatherproof* nut.

APPLETON ELECTRIC PRODUCTS

# APPLETON

CONDUIT FITTINGS • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

VITAL FIRST LINES FOR INDUSTRIAL ELECTRICAL CONTRACTORS

fostoria SERVICE

# Better Weapons for the WAR PRODUCTION FRONT

## Better Baking and Drying with Near Infra-Red

INFRA-RED fostoria PARA-SPHERE

**EQUIPMENT FOR BAKING, DRYING, PREHEATING AND DEHYDRATING**

Alive to the urgency of war needs, industrial contractors are aggressively promoting production speed-up with modern time-saving, space-saving equipment. The amazingly advantageous Infra-red process is an outstanding example of successful accomplishment in this vital effort.

By this process, radiant energy generated by Infra-red lamps is directed by reflectors upon objects being processed where it converts into heat. This highly efficient method of direct heat application greatly speeds production output, reduces space needs and has low fuel cost. It is quickly and easily adaptable to "line operations" for baking, drying, preheating or dehydrating.

The approved line of Fostoria equipment and technical service, already utilized by hundreds of war plants, provides industrial contractors a foremost opportunity for volume sales today and after the war is won.

## Better Seeing on the Job with Balanced Lighting

With production of war goods has come greatly increased demand on workers' eyes. Finer detail, closer tolerances, more severe inspection, and greater speed have made vital better tools for "seeing" on the job.

Fostoria balanced lighting has provided these better tools. By combination of localized lighting with general lighting, efficient balance is obtained of needed footcandles on the work area and proper background light. Workmen see quicker, accurately without tiring eyestrain.

In Fostoria Generalites and Fostoria Localites, industrial contractors have the equipment to most expertly increase war worker "seeing" efficiency. Thousands of war plants have demanded this better service and thousands more need it today.

BALANCED fostoria LIGHTING

**GENERALITES**
**For Background Lighting**

**LOCALITES**
**For Light ON the Job**

*Request full information, now, on these two vital first lines for electrical contractors.*

**THE FOSTORIA PRESSED STEEL CORPORATION**
FOSTORIA, OHIO

What if the POWER fails THIS GUN LATHE?

*Guard* VITAL CIRCUITS WITH

# CENTRAL RIGID STEEL CONDUIT

Vibration, shock, oil, moisture, corrosion . . . . threaten vital industrial power lines every moment . . . . jeopardize important links of productive capacity . . . . menace our Victory Program.

Guard these vital circuits against every service hazard . . . . use Central Rigid Steel Conduit.

For Sale by

**SPANG CHALFANT, INC.**

General Offices:
GRANT BUILDING, PITTSBURGH, PA.
District Offices and Sales Representatives in Principal Cities

VARNISHED CAMBRIC · RUBBER POWER CABLES · BUILDING WIRE · RADIO WIRES · SIGNAL CABLE · FLEXIBLE CORDS · LEAD-ENCASED AND PARKWAY CABLES · ARMORED CABLE

CRESFLEX NON-METALLIC SHEATHED CABLE · SERVICE ENTRANCE CABLE · MAGNET WIRE · BARE WIRE

EVERY MAN, WOMAN & MACHINE
at
CRESCENT

is working 100% to keep the Light of Freedom burning!

CRESCENT INSULATED WIRE & CABLE CO.

CRESCENT
WIRE and CABLE
*Factory:* TRENTON, N. J.—*Stocks in Principal Cities*

CRESCENT ENDURITE SUPER-AGING INSULATION · WEATHER-PROOF WIRE

# Electrical Contracting

*With which is consolidated The Electragist and Electrical Record . . . ESTABLISHED 1901*

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A practical paper for electrical contractors, industrial electricians, inspectors, engineers and motor shops, covering engineering, installation, repairing, maintenance and management, in the field of electrical construction and maintenance.

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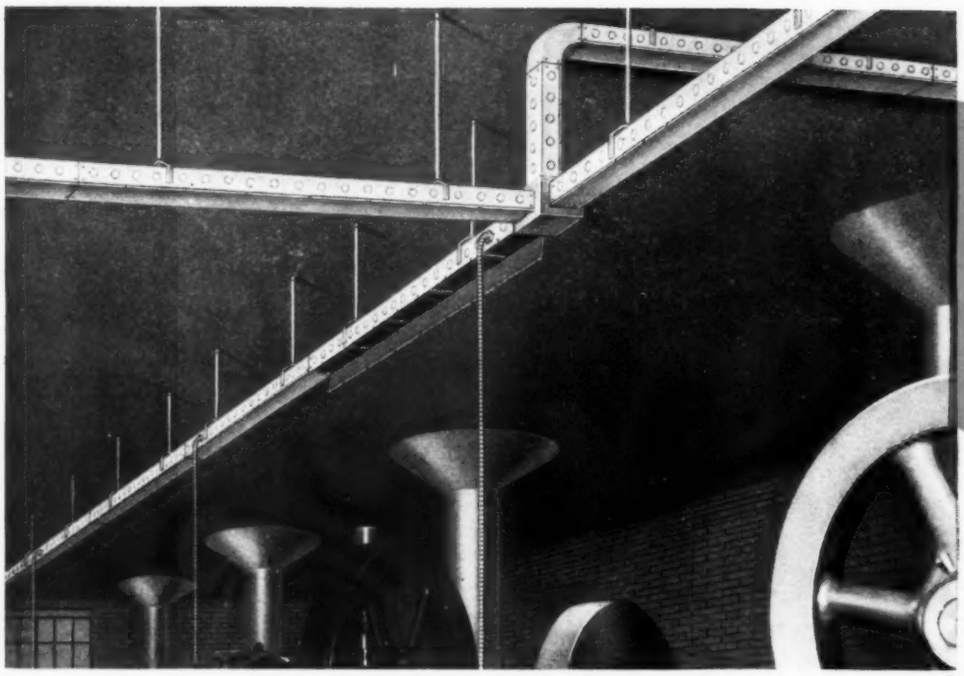

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# Electronics—Secret Weapon of War

## *Presager of a New Scientific and Industrial Era*

THE END of World War I left scientists with a new plaything. They did not know it at the time but they had their hands on a revolution. Within two years the world had radio broadcasting. Within ten years the whole art of motion pictures had been transformed as talking pictures replaced silent movies. Within twenty years television was born and people were seeing pictures in motion by radio.

The fulcrum of this revolution is the electron tube, a new tool of illimitable possibilities. One form of the electron tube is the familiar radio tube; the much publicized electric eye is another. There are many other forms, each having distinct capacities for saving time, saving energy, saving money, protecting life, limb and property.

The electron tube puts the electron to work—and the electron is the basic building-block of the universe.

Electronics is the new art, the new science of putting the electron to work. Radio and sound pictures and television are aspects of electronics; but there are many other facets of this revolution which have been brewing since the last war.

The electron tube has a typical American family tree. Edison made the basic discovery of the "Edison effect" some sixty years ago. This was followed by the invention of the "Fleming valve" and the "de Forest grid". Then Armstrong contributed his share, and hundreds of engineers in garret and cellar workshops and in the great university and industrial laboratories went to work on the tubes which employ electrons. The tube was a plaything before the last war but the world conflict brought it out of the toy stage and made it a practical, powerful tool.

Today the electron tube is guiding the destinies of the greatest armies and fleets ever engaged in the history of the world.

It is a part of the nerve center of the battleship, directing its course, finding its adversaries, broadcasting running accounts of air battles to its crews, directing gun fire and determining ocean depth.

In the air it is the means of locating and identifying enemy planes, piloting planes automatically, giving communication from plane to plane and to shore. It is even operating the controls of the plane.

In the maneuvering tank, in the officer's car, on the back of a foot soldier it transmits and receives vocal messages from every unit of the fighting forces.

Along our borders, and those of our Allies is an electronic screen which counts, follows and identifies enemy planes a hundred miles away through darkness and through fog.

In industrial plants there are electronic counters that enumerate passing articles faster than the eye can see; automatic sorters which discard defective, oversize, undersize, off-color articles; automatic cutters; devices which inspect the inside of things which the eye cannot see; controls which protect workers; controls of temperature; smoke eliminators; intruder alarms; automatic controls for whole batteries of machines.

In its October progress report on American industry, the War Production Board points out that the radio business is five times greater than a year ago. From 20 million dollars a month last fall, it has increased to well over 100 million dollars a month. Unfilled war orders are in excess of 4 billion dollars.

From such vast growth will emerge a new engineering of products which will immeasurably improve our peace-time living.

After the war broadcasting will be infinitely more satisfactory: radio receivers will perform with a new fidelity which will amaze us. Television reception will be as flawless as the motion picture. Present secret war developments will readily be convertible to peace-time devices that will improve our standard of living.

No longer will ships collide with other ships, with icebergs or the shore. No longer will trains collide and aircraft crash in flight.

Garage doors will open as we approach and automatically close themselves. Electric lights will automatically go on and off according to our wants and needs. Furnaces and boilers will be controlled and smokestacks will cease to belch wasteful smoke. Air will be made dust free and germ free. Food contamination will be checked, meat made tender.

Grade crossings will be made safe and auto traffic will be automatically controlled.

Medical science sees new wonders ahead. Already it is possible to see "whiskers" on germs, germs which heretofore had been but a blur when viewed through the strongest optical equipment available.

Today so much secret development is going on in the ultra-high-frequency field that little can be said of its great future. But, without divulging military secrets, it can be said that ply-wood is being dried electronically in minutes instead of hours. Ultra-high-frequency welding (not to be confused with flame welding controlled electronically) is being done dramatically and efficiently.

Ultra-high-frequency heating promises to revolutionize the baking industry—it may even heat our homes.

What is this miracle working tube that can see, hear, taste, feel and smell a thousand times more sensitively than was possible heretofore?

What is the electron? No one knows, not even the scientists who know how to employ it. Electrons cannot be seen or felt; but if 6¼ million million million electrons are pushed through a 100-watt electric lamp per second, it will light up to full brilliance. For electric current merely is a mass movement of electrons. Each electron carries its share of electricity, and since the electron has so little weight it can be moved easily and quickly. Therefore, electricity transported by electrons can be turned on or off with great ease and speed. The electron tube merely is a device that controls the flow of electricity. It is an amplifier of power which can be made to do wondrous things. The sound of a termite gnawing inside of a log can be amplified a million times . . . to a roar that can be heard over great distances.

Colors can be classified and matched to a degree not possible by any other means.

Chemical or vitamin consistency can be recognized by counting radio activity within the subject being analyzed.

There is no industry in which electronic circuits cannot be used to speed up production, to increase accuracy, to do heretofore impossible tasks of calibration and measuring.

The opportunities afforded the engineers who are developing this new "electronic age" are limitless.

* * * *

Today the electronic industry is 100% at war. It is meeting the exacting demands made upon it.

Never before was electronic equipment called upon to withstand temperatures ranging from 75 degrees below to 150 degrees above zero Fahrenheit. Never before did radios and transmitters have to withstand the shaking and abuse to which they are being subjected today.

War demands have called for much redesign, much change of materials and a new conception of operating to tolerances never dreamed of in peace-time material. As a result, electronic parts and equipment makers are building better devices.

Universities and colleges are working at top speed to produce electronic engineers, for every radio operator in a plane, every radio man in the ground forces and on ships, every man operating radar equipment or electronic control devices in ordnance . . . and there are many thousands of them . . . must be a trained technician.

The wall of military censorship is high but it is no secret that one of Britain's best weapons that keeps the Luftwaffe from exterminating London is a radio locator, a device that gives alarm of approaching planes long before they can be seen with telescopes. Scanning the horizon constantly the locator warns of the enemy's approach. In the nose of a night fighter, the locator informs pilot and gunner when the enemy is within range. Neither is it a military secret that gunfire can be controlled by electronics, and that electronics is having a big share in training our new armies.

Necessity draws a veil over the most dramatic uses of electronics in warfare, but among those who know there is nothing secret about the fact that many of today's wartime applications will revolutionize our peace-time lives. Electronics will invade every industry with totally new devices and machines. The future of the electronics industry is limited only by man's imagination.

Such is electronics, and its destiny!

*President, McGraw-Hill Publishing Company, Inc.*

***This is the sixth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers, and in daily newspapers in New York, Chicago and Washington, D. C. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.***

Electrical Contracting

# IT'S NOT PERFECT

It would be nice to report that the new Maximum Price Regulation for construction and maintenance has been received with universal acclaim by the industry. It hasn't. But universal and ready compliance is vitally important.

Nobody likes such price regulation and nobody wants it. That's because we live in a democratic country. We have been brought up to abhor regimentation. But nobody likes war either. Yet our boys are giving some rats who profess that war is the height of social progress some lessons in tough fighting.

In the same way, the construction industry is accepting MPR 251 as an essential if not especially palatable move in the battle against inflation. And the men heading up OPA are realistic enough to recognize that sincere cooperation with the purpose and intent of the regulation need not be accompanied by ardent enthusiasm for every paragraph.

There are several points of honest criticism that deserve careful study. They will undoubtedly become the basis for wide protests. One is that MPR 251 was drawn and issued without sufficient consultation with the industries affected. This is a matter of individual opinion, but since several months passed between General Max and MPR 251 it seems that more than one all-industry conference could have contributed much to its preparation.

The requirement specifying two reports on a contract job, one an estimated breakdown and the other actual costs is arousing some concern. What if the contractor gets a "break" on a job? To what extent is he legally accountable for the accuracy of his estimated figures. These questions need clearing up and they probably will be.

Excepted from the Regulation are any products or services covered by any other regulation. This is totally unnecessary confusion. It leaves to the individual contractor the task of scanning and interpreting literally hundreds of other regulations. Practically there are only a few which might conflict, such as 82, 136 and 165. But why should there be any? The purposes of price regulation can be fully served under MPR 251.

Some strong protests will be made and, we hope, result in appropriate revisions to the regulation. Our industry can be expected to cooperate thoroughly with the intent and purpose and to do its doggondest to comply with the letter of the new law. And we can't do less.

THE job of protecting plants from sabotage and sudden danger is first of all an *electrical* job . . . something that's most quickly and efficiently handled by local electrical contractors.

Take, for example, outdoor lighting. The right searchlights and floodlights can make it virtually impossible for an intruder to enter or approach the plant without being seen by a watchman.

Well-planned installation of burglar alarms, fire alarms, sirens, bells and other emergency warning signals can go a long way toward thwarting the efforts of the internal saboteur. Together with intercommunication and paging systems, these signaling devices also form the nucleus of efficient air raid "alerts". Installation of emergency power circuits or other wiring changes to permit interruption of key operation will often be needed as well.

Any war job you may be tackling today . . . industrial conversion . . . army camps . . . air bases . . . shipyards . . . defense housing . . . can be kept moving ahead on schedule when you have the advantage of a strong *local* source of supplies. And, that's just what you have when you deal with GRAYBAR.

More than 200 leading manufacturers of the equipment frequently specified for these and other war jobs depend on GRAYBAR to speed their products to the point of need. GRAYBAR specialists are always ready to help you in planning or in meeting unusual problems on lighting, signaling or any other electrical need.

**These Graybar-distributed products are widely used on Industrial Jobs**

***Crouse-Hinds*** searchlights, floodlights and other special types of outdoor lighting. Also ***Benjamin*** outdoor lighting equipment and ***General Electric*** street lighting units. ***General Electric*** Mazda lamps.

***Graybar*** Inter-Phones, ***Webster Electric*** Teletalk and ***Edwards*** Lokator. Also, ***Horni*** fire alarm systems, ***Federal*** Sirens and other signaling and alarm equipment.

***BUS***tribution Duct and other modern wiring specialties and supplies. ***General Electric*** Motors and motor control. Cable, conduit, wiring devices, panel boards, circuit breakers, fuses and miscellaneous supplies.

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# Contractor Prices under Special Regulations

**Materials at cost, labor at July '42 rates, margin at March '42 levels are established as ceiling price basis for entire construction industry.**

A NEW regulation providing specialized price control for the vast American construction industry was issued Oct. 31 by Price Administrator Leon Henderson.

The regulation covers all construction and maintenance services and sales in which contractors, builders, installers and erectors furnish building or industrial equipment or materials, together with the labor or services required for actual construction, installation or service.

Ceilings established by the new regulation are the equivalent of those generally in effect during March, 1942, adjusted for increases in labor costs between March 31, 1942, and July 1, 1942, the date on which the construction industry stabilization agreement between certain government agencies and the Building Trades Department of the American Federation of Labor became effective.

The field covered by the regulation is so broad that it extends from the simple repair of a leak in a roof to the construction of a great project like Boulder Dam. Included are such jobs as the stringing of new telephone or power lines, and the construction of streets and sewers. Ceilings also are established on everyday ordinary household repair and service jobs by plumbers, paperhangers, carpenters and electricians.

Representatives of the interested unions, as well as contractors and representatives of the national contractors' associations along with Government representatives, participated in the conferences which led to the formulation of the regulation.

The new controls are contained in Maximum Price Regulation No. 251—Construction and Maintenance Services and Sales of Building and Industrial Equipment and Materials on an Installed or Erected Basis—and became effective November 5, 1942.

In order to adjust the pricing mechanism to the nature and practices of the industry and to simplify its administration, maximum pricing formulas have been established for three different types of sales: (1) sales of all types not in excess of $500; (2) sales in excess of $500 on a cost-plus basis; and (3) sales in excess of $500 on lump-sum basis.

A short formula has been outlined for the sales below $500.

This is: to the price which would have been charged for the sale in March, 1942, the seller may add the increases in labor costs on the job up until July 1, 1942. The result is his maximum price.

For contracts of more than $500 on a basis of cost plus a percentage of cost, or cost plus a fixed fee, or any other basis in addition to cost, maximum prices are to be computed as outlined below:

1. Materials and supplies at actual cost.

2. Labor at actual cost, but in amount not to exceed labor costs at rates in the area of installation in effect on July 1, 1942.

3. Other direct actual costs, including cost of sub-contracts.

4. Margin for overhead and profit at March (1942) rate, based on a comparable sale, or under certain circumstances, the seller's general experience and that of the industry.

In contracts of more than $500 on a lump-sum basis, maximum prices are to be computed as follows:

1. Estimated cost of materials and supplies.

2. Estimated labor costs on the basis of rates in the area of installation in effect July 1, 1942.

3. Estimated other direct costs, including sub-contracts.

4. Estimated reserve for contingencies.

5. Estimated margin for overhead and profit at March (1942) rates, listing the method by which this is computed.

## HOW TO REPORT

**Cost Plus** 1397.56

1 Within 10 days after entering into a cost plus contract, submit the following data to the nearest OPA office.

a. A description of the job
b. An estimate of the cost
c. The percentage margin or fixed fee

**Contract** 1397.57

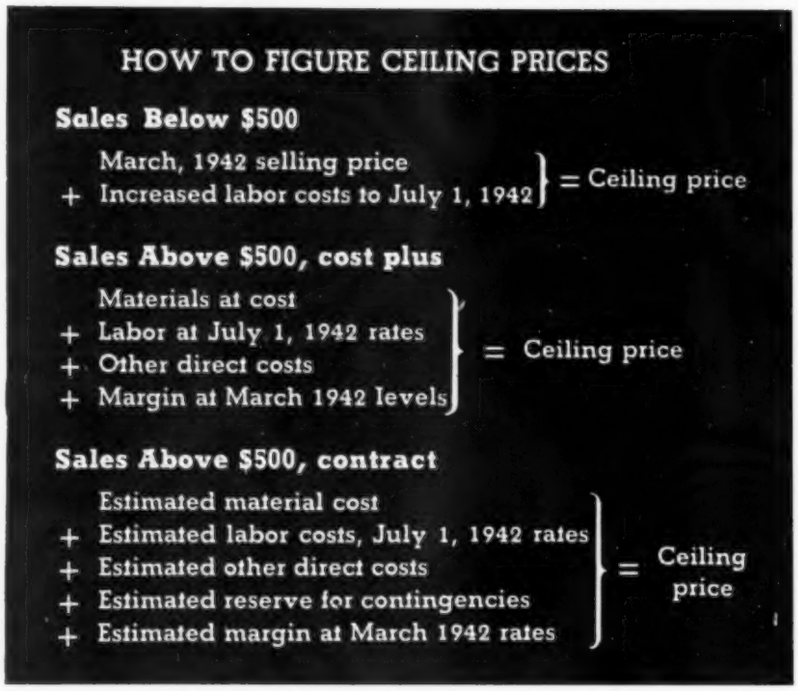
2 Within 10 days after entering into a contract, submit the following data to the nearest OPA office.

a. A description of the job
b. Estimated cost of materials
c. Estimated labor costs
d. Estimated other direct costs
e. Estimated reserve for contingencies
f. Estimated margin (in dollars) and method by which it is computed
g. The contract price

3 No less than 10 days before final settlement, submit the following data to the same OPA office.

a. Actual materials cost
b. Actual labor cost
c. Actual other direct costs
d. Actual cost of contingencies

Estimate sheets or other working papers may be filed in lieu of the above reports provided that the required information is fully set forth therein.


HOW TO FIGURE CEILING PRICES
Sales Below $500
March, 1942 selling price
+ Increased labor costs to July 1, 1942
= Ceiling price
Sales Above $500, cost plus
Materials at cost
+ Labor at July 1, 1942 rates
+ Other direct costs
+ Margin at March 1942 levels
= Ceiling price
Sales Above $500, contract
Estimated material cost
+ Estimated labor costs, July 1, 1942 rates
+ Estimated other direct costs
+ Estimated reserve for contingencies
+ Estimated margin at March 1942 rates
= Ceiling price

(Document No. 6329)

PART 1397—CONSTRUCTION OF BUILDINGS AND STRUCTURES [MPR 251]

CONSTRUCTION AND MAINTENANCE SERVICES AND SALES OF BUILDING AND INDUSTRIAL EQUIPMENT AND MATERIALS ON AN INSTALLED OR ERECTED BASIS

In the judgment of the Price Administrator it is necessary and proper to establish a method of determining maximum prices for sales of construction and maintenance services and building and industrial equipment and materials on an installed or erected basis which differs, in some respects, from the method of computing maximum prices established therefor by the General Maximum Price Regulation. So far as practicable, the Price Administrator has advised and consulted with representative members of the industries which will be affected by this regulation.

The maximum prices established by this regulation, in the judgment of the Price Administrator, will be fair and equitable, and will effectuate the purposes of the Emergency Price Control Act of 1942, as amended, and Executive Order No. 9250. A statement of the considerations involved in the issuance of this regulation has been issued simultaneously herewith and filed with the Division of the Federal Register.*

Therefore, under the authority vested in the Price Administrator by the Emergency Price Control Act of 1942, as amended, and Executive Order No. 9250, in accordance with Procedural Regulation No. 1,[1] issued by the Office of Price Administration, Maximum Price Regulation No. 251 is hereby issued.

Sec.

1397.51 General Maximum Price Regulation superseded.
1397.52 Definitions.
1397.53 Exclusions.
1397.54 Prohibition against sales at higher than maximum prices.
1397.55 Maximum prices for sales under $500.
1397.56 Maximum prices for sales on a cost-plus basis.
1397.57 Maximum prices for sales on a unit price or lump-sum basis.
1397.58 Bonuses.
1397.59 Special pricing methods.
1397.60 Less than maximum prices.
1397.61 Certificates of compliance.
1397.62 Notification of purchasers of existence of regulation.
1397.63 Evasion.
1397.64 Records and reports.
1397.65 Licensing.
1397.66 Registration of licensee.
1397.67 Enforcement.
1397.68 Petitions for amendment or adjustment.
1397.69 Geographical applicability.
1397.70 Effective date.

AUTHORITY: §§ 1397.51 to 1397.70, inclusive, issued under Pub. Laws 421 and 729, 77th Cong.; E.O. 9250, 7 F.R. 7871.

§ 1397.51 *General Maximum Price Regulation superseded.* The provisions of the General Maximum Price Regulation are superseded with respect to sales of construction and maintenance services and sales of building and industrial equipment and materials on an installed or erected basis for which maximum prices are in effect pursuant to this Maximum Price Regulation No. 251, or which are exempted from this Maximum Price Regulation No. 251 under the provisions of § 1397.53 (f) hereof.

§ 1397.52 *Definitions.* (a) When used in this Maximum Price Regulation No. 251, the term:

(1) "Person" includes an individual, corporation, partnership, association, or any other organized group of persons, or legal successor or representative of any of the foregoing, and includes the United States or any agency thereof, or any other government, or any of its political subdivisions, or any agency of any of the foregoing.

(2) "Building or individual equipment or materials" includes any raw material, commodity, or processed or fabricated article used in or made a part of any building or construction project.

(3) A "sale on an installed or erected basis" means a transaction in which the seller furnishes building or industrial equipment or materials, together with the labor or services required to incorporate such building or industrial equipment or materials into a building, structure, or construction project.

(4) "Construction or maintenance services" means all services rendered with respect to any building, structure, or construction project or any part thereof.

(5) "Price regulation" means a price schedule effective in accordance with the provisions of section 206 of the Emergency Price Control Act of 1942, a maximum price regulation or temporary maximum price regulation issued by the Office of Price Administration, or any order issued pursuant to any such regulation or schedule.

(6) "Government contract" means any contract with the United States or any agency thereof or with the government of any country whose defense the President deems vital to the defense of the United States under the terms of the Act of March 11, 1941, entitled "An Act to Promote the Defense of the United States" or with any agency of any such government.

§ 1397.53 *Exclusions.* This Maximum Price Regulation No. 251 shall not apply to the sale or supplying of:

(a) Any service which is excluded from the General Maximum Price Regulation by Paragraph (b) of Revised Supplementary Regulation No. 11 to the General Maximum Price Regulation, as amended, including future amendments thereto;

(b) Any service specified in § 1499.101 (c), as amended, including future amendments, of Maximum Price Regulation No. 165, as amended—Services;

(c) Any construction or maintenance service or any commodity on an installed or erected basis for which a maximum price is established by any other price regulation[2] except the General Maximum Price Regulation;

(d) Any construction or maintenance service or any building or industrial equipment or materials on an installed or erected basis not delivered or supplied for use on a fixed structure or fixed construction project;

(e) Any construction or maintenance service or any building or industrial equipment or materials on an installed or erected basis pursuant to a contract entered into prior to the date of issuance of this regulation. Any substantial revision or modification of a contract shall be deemed a new contract for the purposes of this paragraph;

(f) Any construction or maintenance service or any building or industrial equipment or materials on an installed or erected basis pursuant to a prime contract with the War Department, the Navy Department, or any agency of the United States whose contracts are classified hereunder by order of the Office of Price Administration, or any subcontract to such prime contract: *Provided,* That the War Department, the Navy Department, or other agency of the United States classified hereunder shall certify, at the time

*Copies may be obtained from the Office of Price Administration.

[1] 7 F.R. 971, 3663, 6967.

[2] See, for example, Revised Price Schedule No. 136—Machines and Parts.

the contract or subcontract is made, that the contract or subcontract has been negotiated or will be renegotiated in accordance with a method previously filed with the Office of Price Administration: and *Provided further,* That, notwithstanding the other provisions of this paragraph (f), the seller shall remain subject to the provisions of § 1397.61 (c) of this Maximum Price Regulation No. 251.

§1397.54 *Prohibition against sales at higher than maximum prices.* (a) On and after the effective date of this Maximum Price Regulation No. 251:

(1) No person shall sell or deliver or contract to sell or deliver building or industrial equipment or materials on an installed or erected basis, or sell or supply any construction or maintenance service, at a price higher than the maximum price established by this Maximum Price Regulation No. 251.

(2) No person, in the course of trade or business, shall buy or receive any building or industrial equipment or materials on an installed or erected basis, or any construction or maintenance service at a price higher than that permitted by this Maximum Price Regulation No. 251: *Provided,* That if upon completion of a sale subject to this Regulation the purchaser shall receive from the seller a written affirmation that to the best of his knowledge, information, and belief, the prices charged do not exceed the maximum price established by this Maximum Price Regulation No. 251; and if the purchaser shall have no knowledge of the maximum price and no cause to doubt the accuracy of the affirmation, and if the actual price paid is not in excess of the maximum price as affirmed by the seller, the purchaser shall be relieved of liability under this section. The certificate provided for in § 1397.61 (a) or (b) hereof shall be deemed a written affirmation for the purposes of this section.

(3) No person shall agree, offer, solicit, or attempt to do any of the acts prohibited in subparagraphs (1) and (2) of this paragraph (a).

(b) The provisions of paragraph (a) (2) of this section shall not be applicable to any agency of the United States, or any contracting officer thereof, and any such contracting officer or any paying finance officer shall be relieved of any and every liability, civil or criminal, imposed by this Maximum Price Regulation No. 251 or by the Emergency Price Control Act of 1942.

§ 1397.55 *Maximum prices for sales not exceeding $500.* In the case of any sale subject hereto, the price for which in March 1942 would not have exceeded $500, the seller shall determine his maximum price hereunder as follows:

To the price which would have been charged for said sale in March 1942 (based on his then prevailing rates for labor and material and his then prevailing margin), the seller shall add increases in labor costs thereon up to July 1, 1942. The resulting figure shall be the maximum price for such sale.

§ 1397.56 *Maximum prices for sales on a cost-plus basis.* (a) The maximum price (except as determined under § 1397.55), in the case of sales or contracts to sell on the basis of cost-plus-a-percentage-of-cost, cost-plus-a-fixed-fee, or any other basis of addition to cost, shall be an amount not in excess of the sum of the following:

(1) Materials and supplies at actual cost, but in no event at prices in excess of those permitted by any applicable price regulation of the Office of Price Administration: *Provided,* however, That where the building or industrial equipment or materials are manufactured or processed by the seller, the cost thereof for the purpose of this section shall not exceed the lowest maximum price which the seller would be permitted to charge under any applicable price regulation on a sale of such materials or equipment to a third party purchasing a similar quantity.

(2) Actual labor costs: *Provided, however,* That such costs shall not be allowed in an amount to exceed the cost of such labor computed on the basis of labor rates in the area of installation in effect on July 1, 1942.

(3) Such other actual direct costs incurred by the seller, including the cost of subcontracts, not otherwise provided for in subparagraphs (1) and (2) above: *Provided, however,* That such costs may not be allowed in an amount in excess of the maximum prices fixed therefor by this Maximum Price Regulation No. 251 or by any other applicable price regulation.

(4) A margin to include administrative, supervisory, and overhead costs and profit (excluding any reserve for contingencies) not in excess of such percentage of one or more of the other costs enumerated in paragraphs (1), (2), and (3) of this section as (a) constituted the seller's highest margin similarly calculated during the base period January 1, 1939, to March 31, 1942, on the most comparable sale involving the same type of work, or b) if the margin cannot be determined under (a), a margin which would have constituted the seller's margin similarly calculated in March 1942, on a comparable sale involving the same type of work and based on the seller's own general experience, and the experience of the industry on such comparable sales.

The margin determined hereunder must be supported by records, or other competent evidence, of previous transactions occurring during the base period. These records and evidence must be produced on request of the Office of Price Administration.

(b) Within ten days after entering into any cost-plus contract subject to this Maximum Price Regulation No. 251, the seller shall submit to the nearest district, state, or regional office of the Office of Price Administration a report setting forth a description of the job, an estimate of the costs and a statement of the percentage margin or, in the case of a cost-plus-a-fixed-fee contract, the estimated margin in dollars and cents, as set forth in § 1397.56 (a) (1) to (4) above, and an indication of the items of overhead included therein.

§ 1397.57 *Maximum prices for sales on a unit-price or lump-sum basis.* (a) The maximum contract price (except when determined under § 1397.55), in the case of sales or contracts to sell on a unit price basis or on the basis of a total selling price (inclusive of all costs and profit), commonly referred to as a lump-sum contract, shall be an amount not in excess of the sum of the following:

(1) Estimated cost of materials and supplies at a price not in excess of that permitted by any applicable price regulation of the Office of Price Administration: *Provided, however,* That where the building or industrial equipment or materials are manufactured or processed by the seller, the cost thereof for the purposes of this Maximum Price Regulation No. 251 shall not exceed the lowest maximum price which the seller would be permitted to charge under any applicable price regulation on a sale of such materials or equipment to a third party purchasing a similar quantity.

(2) Estimated labor costs: *Provided, however,* That such costs shall not be allowed in an amount to exceed the cost of such labor computed on the basis of labor rates in the area of installation in effect on July 1, 1942.

(3) Estimated other direct costs, including the cost of subcontracts, applicable to each such sale not otherwise provided for in subparagraphs (1) and (2) above: *Provided,* That any commodity or service included in this estimate, whether subject to this Maximum Price Regulation No. 251 or any other applicable price regulation may be included only at a price not in excess of the maximum price permitted by any such regulation.

(4) An estimated reserve for such contingencies as the seller in good faith can reasonably foresee.

(5) A margin to include administrative, supervisory, and overhead costs and profit not in excess of such percentage of one

## HOW TO COMPLY WITH THE RULES

1. Notify customer before contract is entered of the existence of MPR 251. 1397.62
2. Have copy of MPR 251 available at your place of business for examination by the customer. 1397.62
3. On final settlement provide a certificate of compliance to the customer. 1397.61
4. Keep complete and detailed records of every transaction showing name of purchaser, date of transaction, description of commodities and services involved, statement of method used to calculate price, together with all records customarily kept. 1397.64

or more of the other estimated costs enumerated in the paragraphs (1), (2), (3), and (4) of this section as (a) constituted the seller's highest margin similarly calculated during the base period January 1, 1939, to March 31, 1942, on the most comparable sale involving the same type of work, or (b) if the margin cannot be determined under (a), a margin which would have constituted the seller's margin similarly calculated in March 1942, on a comparable sale involving the same type of work and based on the seller's own general experience, and the experience of the industry on such comparable sales.

The margin determined hereunder must be supported by records, or other competent evidence, of previous transactions occurring during the base period. These records and evidence must be produced on request of the office of Price Administration.

(b) Within ten days after entering into any unit price or lump-sum contract subject hereto, the seller shall submit to the nearest district, state, or regional office of the Office of Price Administration a report setting forth:

(1) A complete description of the job;
(2) Estimated costs of materials and supplies;
(3) Estimated labor costs;
(4) Estimated other direct costs, including the cost of each subcontract;
(5) Estimated reserve for contingencies;
(6) Estimated margin and the method by which it is computed; and
(7) The contract price.

No less than ten days before the anticipated final settlement under the lump-sum contract, a further report shall be submitted to the office to which the initial report was submitted, setting forth the actual costs for each of the above-mentioned items (2) to (5), inclusive. The seller may file his estimate sheets or other working papers in lieu of the reports required hereunder, or any part thereof, provided that the required information is fully set forth therein.

§ 1397.58 *Bonuses.* No seller shall charge, demand, or receive, and no buyer shall tender or pay, any bonus, consideration, gratuity, or any other addition to the maximum price, calculated on the basis set forth in this Maximum Price Regulation No. 251, and no seller or buyer shall agree to do any of the foregoing for early completion of such sale or for any other reason, except upon specific approval and authorization of the Office of Price Administration. Applications for such authorization shall be filed with the Office of Price Administration, Washington, D. C., and shall set forth a description of the job and its location, the contract price for the job, the amount of the proposed bonus, and the reasons for requesting permission to provide for it.

§ 1397.59 *Special pricing methods.* The Office of Price Administration may by order under this section provide a special pricing method to replace the pricing method set forth herein for any industry, or part thereof, subject to this Maximum Price Regulation No. 251.

§ 1397.60 *Less than maximum prices.* Lower prices than those provided for in this Maximum Price Regulation No. 251 may be charged, demanded, paid, or offered.

§ 1397.61 *Certificates of compliance.* (a) In the case of any sale subject to this Maximum Price Regulation No. 251 in which the total sale price exceeds $500, the seller, at the time of final settlement, shall furnish a certificate to the purchaser setting forth the ceiling price as determined under this Maximum Price Regulation No. 251 and the sale price, together with a statement that the terms of this Regulation have been complied with. A duplicate of this certificate shall be filed with the nearest district, state, or regional office of the Office of Price Administration.

(b) A certificate similar to the one provided for in paragraph (a) of this section shall be furnished to the purchaser in the case of any sale under $500 where demand thereof is made by the purchaser.

(c) In the case of any sale excluded from this Maximum Price Regulation No. 251 under the provisions of § 1397.53 (f), the seller shall file with the Office of Price Administration, Washington, D. C., at any time before final payment, a certificate that it has purchased or rented no equipment or materials at prices higher than the maximum prices permitted under the terms of any applicable price regulation.

§ 1397.62 *Notification of purchaser of existence of regulation.* Every person making sales subject to this Maximum Price Regulation No. 251 shall, before entering into a contract or making a sale, notify the purchaser of the existence of this Maximum Price Regulation No. 251, and, upon request of the purchaser, make available a copy of this Maximum Price Regulation No. 251 at the seller's principal place of business and at every branch office for examination by the purchaser.

§ 1397.63 *Evasion.* The price limitations set forth in this Maximum Price Regulation No. 251 shall not be evaded, whether by direct or indirect methods in connection with an offer, solicitation, agreement, sale, transfer, or purchase of, or relating to, any sale of building or industrial equipment or materials on an installed or erected basis, or any construction or maintenance service, alone, or in conjunction with any other commodity or service, or by way of commission, service, transportation, or other charge, rebate, discount, premium, or other privilege, or by tying-agreement or other trade understanding, or by requiring the purchaser to furnish material for processing not in accordance with previous practice or by reducing the period of any guaranty or warranty of performance, or by eliminating or reducing any maintenance, repair or installation service, or by undervaluing commodities received in trade, or by eliminating or reducing credits on purchases, or by lowering quality, or by any other change in terms, methods, or conditions of sale, delivery, or supply, or otherwise.

§ 1397.64 *Records and reports.* (a) Persons subject to this Maximum Price Regulation No. 251 shall keep available for inspection by representatives of the Office of Price Administration for so long as the Emergency Price Control Act of 1942 remains in effect full records of each sale of building or industrial equipment or materials on an installed or erected basis, and of all sales of construction and maintenance services, after the effective date of this Maximum Price Regulation No. 251, showing the name of the purchaser, the date of the transaction, a description of the commodities and services involved, a detailed statement of the method by which the maximum price was calculated, together with all such records of a kind which the seller has customarily kept. Any person subject to this Maximum Price Regulation No. 251 who has regularly furnished customers with invoices, sales slips, receipts, or similar documents shall continue to do so.

(b) Such persons designated in paragraph (a) of this section shall submit such reports to the office of Price Administration and keep such other records in addition to, or in place of, the records required in paragraph (a) of this section as the Office of Price Administration may from time to time require.

§ 1397.65 *Licensing.* Every person making or contracting to make any sale of building or industrial equipment or materials on an installed or erected basis, or any sale of construction and maintenance services, for which a maximum price is established by this Regulation, is hereby granted a license as a condition of making such sale. Such license shall be effective on the effective date of this regulation or when any such person becomes subject hereto, and shall, unless suspended in accordance with the provisions of the Emergency Price Control Act of 1942, remain in effect as long as this regulation or any applicable part, amendment, or supplement remains in effect.

§ 1397.66 *Registration of licensee.* Every person hereby licensed may be required to register with the Office of Price Administration at such time and in such manner as the Administrator may hereafter by regulation prescribe.

§ 1397.67 *Enforcement.* (a) Persons violating any provisions of this Maximum Price Regulation No. 251 are subject to the criminal penalties, civil enforcement actions, license suspension proceedings, and suits for treble damages provided for by the Emergency Price Control Act of 1942.

(b) Persons who have evidence of any violation of this Maximum Price Regulation No. 251, or any other price regulation, or of any acts or practices which constitute such a violation are urged to communicate with the nearest district, state, or regional office of the Office of Price Administration, or its principal office in Washington, D. C.

§ 1397.68 *Petitions for amendment or adjustment*—(a) *Government contracts or subcontracts.* Any person who has entered into or proposes to enter into a Government contract or a subcontract under any such contract, who believes that a maximum price established by this Maximum Price Regulation No. 251 impedes or threatens to impede production of a commodity or supply of a service which is essential to the war program and which is, or will be, the subject of such contract or subcontract may file an application for adjustment of that maximum price in accordance with Procedural Regulation No. 6, issued by the Office of Price Administration.

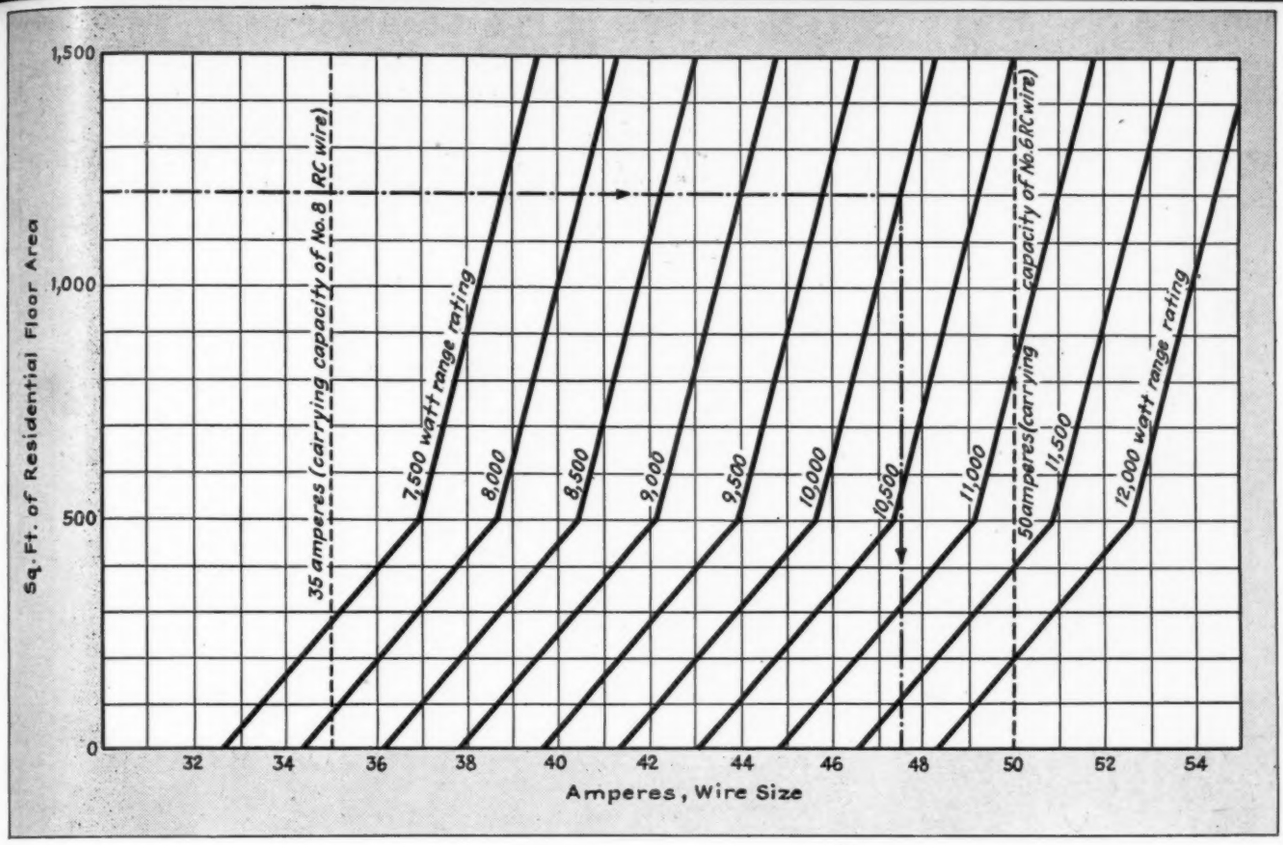
(b) *General amendments.* Any person seeking an amendment of any provision of this Maximum Price Regulation No. 251 may file a petition for amendment in accordance with the provisions of Procedural Regulation No. 1, issued by the Office of Price Administration.

§ 1397.69 *Geographical applicability.* The provisions of this Maximum Price Regulation No. 251 shall be applicable to the continental United States and the District of Columbia, but shall not be applicable to the territories and possessions of the United States.

§ 1397.70 *Effective date.* This Maximum Price Regulation No. 251 (§§ 1397.51 to 1397.70, inclusive) shall become effective November 5, 1942.

Issued this 30th day of October 1942.

LEON HENDERSON,
Administrator.




# Determining Residential Loads

**Quick and accurate estimates of residential service conductor sizes can be made with this new chart.**

**By Arthur L. Bennett**

THE purpose of this graph is to supply a fast, simple, but accurate method of determining load currents and wire sizes for residential lighting and cooking services. The graph is intended to take care of the usual residential jobs, but cannot be used for residences having occupied areas of over 1,800 square feet or ranges with nominal rating in excess of 12,000 watts; jobs exceeding these extremes would require an individual calculation in any case.

The equation which was plotted was derived as follows:

Let $A$ be the occupied area in square feet

Let $W$ be the range rating in watts

Let $I$ be the load current to be determined

Then, from an inspection of the National Electrical Code, the following is true providing that A equals 500 sq. ft. or more.

$$I = \frac{2{,}500 + .3\,[(2A + 1{,}500) - 2{,}500] + .8W}{230}$$

which simplifies to:

$$I = 9.565 + .002609A + .003478W$$

The simplified equation is readily plotted by choosing an arbitrary value for $W$ and plotting the resultant linear equation having the two variables $I$ and $A$. The graphs are projected down to the horizontal axis by calculating each current value for the assumed value of $W$ when $A$ equals zero.

The derivations hereinbefore stated are included for completeness, but the contractor and inspector will be interested in the application of the graphs. Let us take an example:

Residence size 30 by 40, with all living areas on one floor.

Nominal range rating 10,000 watts.

From vertical line at the left follow over from the 1,200 sq. ft. line horizontally to where it intersects the 10,000 watt graph line. From this point of intersection drop down along a vertical line to the current scale. The reading is 47.5 amperes. Calculating this problem with the same values by use of the conventional manner gives a value of 47.48 amperes.

In accordance with the latest code requirements which establish the current carrying values of RC wire back to the values stated in the 1937 code, two vertical lines have been drawn in, one at 35 for No. 8 wire and one at 50 amperes for No. 6 wire. In the example used, the conductor size required would be No. 6 since the current value (47.5) amperes is to the left of the 50 ampere line.

A considerable saving in time can be accomplished by using the graph instead of calculating the current in specified cases.

# Protect your Business Security

By Arthur Roberts

**GEORGE HARPER**

**ELECTRICAL CONTRACTOR**

***Profit and loss statement***

| | October 1942 | October 1941 | October 1940 | October 1939 |
|---|---|---|---|---|
| Sales | $25,000 | | | |
| Cost of sales — materials, labor and direct job expense | 17,500 | | | |
| Margin on sales | $7,500 | | | |
| *Overhead expenses* | | | | |
| Management salaries | $1,300 | | | |
| Other salaries | 1,100 | | | |
| Non-productive labor | 1,020 | | | |
| Rent or ownership expense | 200 | | | |
| Light, heat, power | 125 | | | |
| Stationery and office supplies | 55 | | | |
| Traveling and entertainment | 220 | | | |
| Telephone and telegraph | 35 | | | |
| Postage | 10 | | | |
| Advertising | 45 | | | |
| Taxes | 400 | | | |
| Insurance | 350 | | | |
| Association expense | ... | | | |
| Interest paid | 100 | | | |
| Automobile expense | 150 | | | |
| Maintenance and repairs | 50 | | | |
| Collection expense | 250 | | | |
| Legal and accounting service | ... | | | |
| Interest on investment | ... | | | |
| Allowance for loss on notes and accounts receivable | 120 | | | |
| Depreciation on automobiles | 100 | | | |
| Depreciation on tools | 20 | | | |
| Depreciation on merchandise | 20 | | | |
| Depreciation on building | 100 | | | |
| Depreciation on office equipment | 20 | | | |
| Depreciation on furniture and fixtures | 10 | | | |
| Miscellaneous expense | 1,200 | | | |
| Total overhead expense | $7,000 | | | |
| Net profit on October 1942 sales | $500 | | | |

**Monthly profit and loss analysis guards against blind business. Another business control article by an expert accountant specializing in electrical contracting firms.**

WHILE working on accounting commitments in the electrical contracting field, we polled 209 contractors of various size in different eastern communities anent the preparation of profit and loss statements and got the following result:

| | Percent |
|---|---|
| 65 Prepared statements quarterly | 31 |
| 82 Prepared statements semi-annually | 39 |
| 46 Prepared statements annually | 22 |
| 16 Prepared statements monthly | 8 |
| 209 Electrical contractors polled | 100 |

Do you know what is wrong with this quiz picture? Only eight percent are playing safe, 92 percent are doing business "in the blind," bad enough in peacetime, but dynamite now. And if this poll is a reasonable test-check for the remainder of the country, which seems likely, it indicates that the electrical contractor is inviting a blitz in this war economy period.

Because of the fast change of business pace today, the contractor should go into a huddle with his operating figures monthly. Every element of operation should stand out as clean-cut as a display of merchandise under a well-engineered lighting job. It is definitely bad business management to let a month pass these days without knowing where you stand on profit or loss.

Our poll also disclosed that only 35 contractors, or 17 percent analyzed their statements properly after they got them. Among the number were 7 of the 16 who had profit and loss statements prepared monthly. Even if you get monthly statements, it will do little good if you take a hurried look-see at one figure, the net result, and file away. Every statement must be analyzed intelligently. Yet, 83 percent of these contractors made no proper analysis. This indicates why electrical contractors, in the past, have known less about their cost of doing business than other business people who made it a practice to analyze their operating expenses critically, from month to month, period to period.

Take George Harper's profit and loss statement for October 1942 and let's use it as a guide in discussing this subject. When analyzing his statement, Harper should compare it, item for item, with the October statement for three previous years. Even if conditions are such that correctives cannot be applied, you should know where you stand. With margins slimmed by ceilings, inventory restricted because of priorities, sales likewise, you've got to know the answer to your managerial efforts month-to-month, whether good or bad. The peacetime fallacy of working "in the blind," depending upon annual or semi-annual profit and loss statements is gone with the wind.

Notice that Harper lumps sales. They should be departmentalized: to wit: wiring jobs, lighting, industrial installations, sound equipment, home modernization, etc. Or classified according to specific lines, if such sales are a large part of total, such as fluorescent lighting, bus duct systems, automatic telephones, etc. Overhead should be pro-rated to each department or line, instead of totaled for the business, as a whole, as Harper handles it. You must pin your profits down to source these days. You must know

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# MAINTAINING INDUSTRIAL CONTROL

**Practical ideas for keeping industrial electrical control apparatus operating under normal and emergency conditions.**

**By O. H. Hurst**
*New York Service Shop*
*General Electric Company*

ANYONE who has perused a catalog of industrial electric control equipment, such as issued by the larger electrical manufacturing companies, will realize that devices for the control of electric power apparatus are so numerous and diversified in function and design that in a short article such as this, one can do little more than merely outline some of the principles involved in good maintenance.

Broadly speaking, there are two types of maintenance—restorative maintenance and preventive maintenance. It is more common to think of maintenance in terms of its restorative aspect. A device fails and the question is, "What is the quickest way to restore it to its original condition, or at least to a satisfactory operating condition temporarily?". This type of maintenance requires a good technical knowledge of the function, design, and construction of the device, and often requires a good deal of ingenuity and practical experience—plus a knowledge of kinks and quirks that can be resorted to in emergencies.

Needless to say, the carrying of an adequate supply of renewal parts of the quality of the original equipment is usually the best solution to the "fix-it" problem. Also, plant maintenance departments should keep on file any instruction sheet or bulletin that the manufacturer may be able to furnish for each device, for these instructions usually contain hints on maintenance as well as on installation and operation.

The other view of maintenance, the "preventive" aspect, seeks to eliminate the causes of the abnormal symptoms peculiar to a device and, where this may not be wholly possible, to increase the resistance of the device to its diseases or enemies. This type of maintenance calls for a measure of executive ability as well as an adequate technical knowledge of the equipment. To carry it out effectively, one must apply the principles of efficient management, including the keeping of records, the planning, scheduling, and carrying out of routine inspections, tests, and pre-failure repairs and alterations, as well as the establishment and maintenance of standardized conditions and operations based on high ideals of apparatus performance and appearance.

Before discussing the common enemies of industrial control, it may be well to mention three considerations that are not ordinarily associated with the idea of maintenance, but which should be considered from the preventive viewpoint. These are (1) proper selection, (2) proper location, and (3) proper installation of equipment. Obviously, any device that is not suitable for an application either as regards its design or rating, that is placed where it is difficult to inspect or repair, or where its proper functioning is interfered with, or that is not properly installed, will deteriorate faster and require more maintenance than equipment that has been given all of these considerations. Such conditions are often beyond the maintenance man's control, but steps taken to rectify them when possible will often result in reduced maintenance costs and more satisfactory operation.

INSPECTING *a contact tip of a heavy-duty, oil-immersed contactor used in a metal-enclosed high-interrupting capacity controller.*

To effectively guard against the enemies of control equipment, we must know what the enemies are and how they can interfere with the proper operation of the control. This implies that we must also know WHAT each device is supposed to do and HOW it is supposed to do it.

Special or unusual forms of control devices may have special enemies of their own. For instance, the operation of photoelectric equipment may be adversely affected by extraneous light

sources, and delicately balanced magnetic devices may be affected by stray fields. But for the general run of industrial control, we can name four conditions that are usually harmful and which therefore should be guarded against. These conditions are:

1. Excessive amounts of foreign material such as dust, lint, fumes, moisture, etc.
2. Extremes of temperatures (either too high or too low).
3. Excessive vibration.
4. Improper use by operators, resulting in damage and excessive wear.

**1.**—*Excessive Amounts of Foreign Material*

Dusts may be classified as conducting, obstructing, abrasive and combustible.

Metallic dusts, coal dust, and other forms of carbon dust are conducting. When such dusts settle on surfaces between different live parts or between live parts and grounded metal supports or enclosures, the resistance of the leakage paths are often dangerously lowered with resulting arcing and destruction of parts. One naturally expects the danger of breakdown to be proportionately greater at the higher voltages, but experience shows in general that even with the greater clearances provided in equipment designed for higher voltages, the susceptibility to arc-over seems to increase much faster than the voltage, so that conducting dusts are a very dangerous menace in equipment rated 440 volts or above. The best remedy is to protect the equipment by a suitable enclosure where possible.

Sometimes the resistance of the leakage paths can be raised somewhat by coating a portion of each of several live parts with a glyptal varnish which has good insulating properties and which produces a smooth, hard surface to which dust will not readily cling. The varnish also lengthens the leakage path. Spaces between live parts can be coated also.

Other dusts, while not conductors, may accumulate in sufficient quantity to impede the movement of small parts, to keep light contacts from touching each other, or to obstruct ventilating passages in resistor tubes or enclosures. The harmful effects of abrasive dusts are encountered quite frequently in rotating apparatus, and it is conceivable that in some plants they may be a menace to control equipment also. The danger of fire from combustible dusts is, on the other hand, much greater in a control device with standard enclosure than in rotating equipment because of the fact that arcing at contacts is practically unavoidable in control devices not immersed in oil.

For this reason, control devices designed for operation in hazardous atmospheres are often immersed in oil whether the hazard is a dust or a gas. This is particularly true when corrosive fumes are present and where it is most important that the control parts be protected from the chemical action of the fumes. This protection would not be afforded completely by an enclosure which is even nearly air-tight. For explosive dusts and gases, however, special enclosures have been developed which, though not air tight, have labyrinth joints between the boxes proper and the covers, so designed that burning gases emitted by any explosion that might occur inside the enclosure will be cooled below the danger point before they reach the air outside the case, thereby preventing an explosion in the room.

All that has been said regarding dusts, gases, and fumes has two morals; namely, cleanliness and proper protection. The same, of course, applies to steam, salt air, oil, vapor, etc.

**2.**—*Excessive Temperatures*

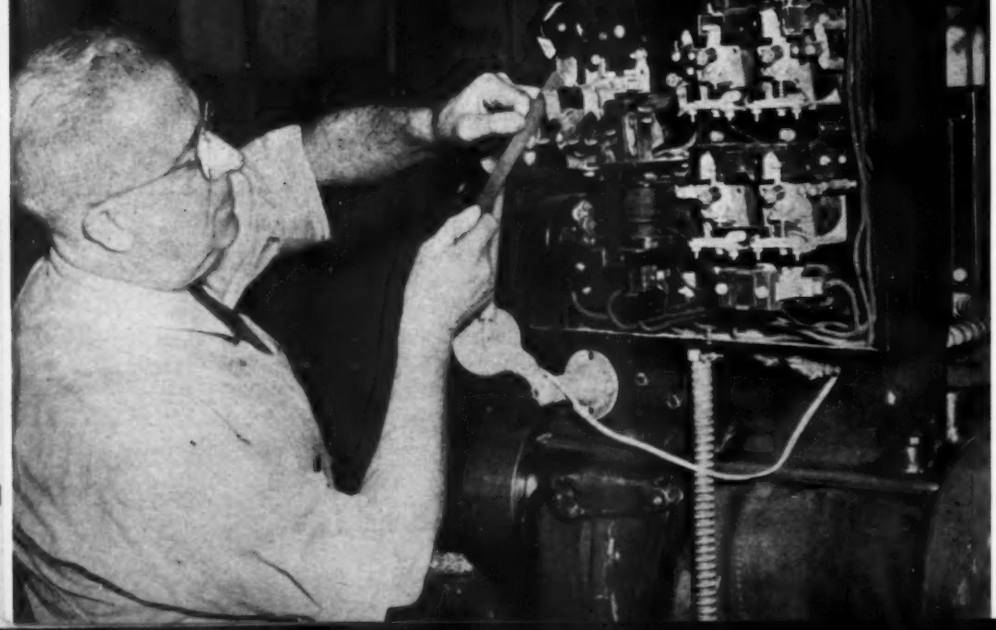
Temperatures that are excessively high or low may interfere seriously with the proper operation of control devices.

The proper care of overload relays, so often neglected, ranks high in maintenance value since their failure to protect against overloads may result in the destruction of motor windings. If the oil used in the dashpots of the older type inverse-time relays when located outdoors is too heavy for the lowest temperature encountered during the year, the action may be too sluggish to give proper protection. If thermal overload relays are located in rooms or areas where the temperature is lower than that in the area in which the machine to be protected is located, or if the relay is subjected to drafts, it will permit a higher overload than that for which it has been calibrated, unless the difference in temperature has been allowed for in calibrating it or in selecting its heater unit.

Therefore, the thermal overload relay should be located in the same room with the motor it protects whenever possible. It should be shielded from drafts, and not mounted near frosted pipes or other objects of extreme temperature that would tend to lower or raise the temperature of the relay heater unit, either by radiation, convection, or conduction.

There is always the temptation to assume that no one from the plant purchasing department to the distributor's stock selector, or your own maintenance man, has made any mistake in selecting the relay or its heater unit, not to speak of the possibility of its having been incorrectly specified by the plant engineering department in the first place. Particular care should be taken, therefore, to see that the relay or its heater unit is of the proper rating.

HIGH RESISTANCE *point is where the movable tips make contact with the stationary tips. Regular cleaning keeps them working.*



In the case of an extremely important drive, it may pay to go to the small expense involved in testing the relay to make sure that it will function properly on the desired value of over-current. Also, it is well to make sure that the heater units are fastened securely in place; that is, that all connections are tight to prevent overheating because of poor contact.

Thus we have exemplified in this common, simple, and cleverly conceived protective device the importance of proper selection, proper location and proper installation. Mention should also be made of the fact that the National Electrical Code recommends that the heater elements of thermal relays be protected by fuses having ratings not over 400 per cent of those of the relay heater elements.

Another common control element that exemplifies the importance of proper selection, proper location, and proper installation is the resistor. Resistors of inadequate capacity will overheat and deteriorate faster than those of ample capacity. The substitution of ribbon-type resistors for the smaller sizes of cast iron grid resistors will greatly reduce maintenance costs when the grids show a marked tendency to break under the influence of severe vibration. In the case of this item, location in a draft would be an advantage, and in cases where resistors may have to be overloaded in an emergency, one or more fans can sometimes be used to advantage in accelerating the dissipation of heat. In any event, proper ventilation should be provided. To this end, resistor tubes should preferably be mounted vertically to realize the benefit of "chimney effect." Plate rheostats should also be mounted vertically so that equal convection can take place from both surfaces of the plate.

Grid resistors should be mounted so that the individual grids have the greatest mechanical resistance to sagging. If the grids are mounted so that they lie in a horizontal plane, they will sag at elevated temperatures, and this may result in the development of short circuits between adjacent grids. Convection air currents also will rise more freely when the grids are mounted in a vertical plane, and the temperature will therefore be less for any given wattage dissipated. The importance of keeping resistor ventilating passages free of foreign material has already been mentioned earlier in this article.

All electrical maintenance men know the electric contacts should be clean and tight to prevent overheating and consequent destruction of joints and adjacent parts. Many, however, are not aware of some of the seemingly strange results that are sometimes traceable to an overheated joint. Thus, one is not likely to think immediately of an overheated joint as being responsible for the failure of two direct-current compound-wound generators to properly divide their load. However, a poor connection in the equalizer circuit will give rise to just this condition and this poor contact may be in a circuit breaker or switch.

A loose connection in the field circuit of a direct-current motor may cause the motor to "flash-over" severely, and the maintenance man may waste much time checking the motor and its load when in reality the trouble may be in that part of the field circuit which passes through the controller.

Heating of copper contacts is accelerated by the formation of copper oxide film on the surfaces. This film has a high resistance. The higher the temperature, the more rapidly the film develops, so that a vicious cycle ensues; the more heat, the more film; the more film, the more heat, etc. The resistance of the oxide film on contact tips of line contactors on motor control panels has been known to build up so high that the resulting current was insufficient to start the motor even without load. The remedy is to keep contacts clean, and in the case of contactor tips this should be done by filing lightly, or just enough to remove the discoloration. The use of sandpaper and emery cloth should be avoided. The larger size contactors are designed so that movable tips slide a small amount on the stationary tips just after making contact. This wiping action tends to keep the tips clean but may not be sufficient to accomplish this if the contactor is heavily loaded and is opened and closed infrequently.

Heating of contactor tips may also be accelerated by insufficient pressure caused by lowered tip spring tension. The obvious remedies are to install new tips if they are badly worn, or new springs if the latter have lost much of their temper.

When contactors are called upon to carry heavy loads for long periods of time, tip heating can usually be reduced by the use of silver tips on the contacts. Although silver oxidizes and the oxide film increases the contact resistance, the oxide film reverts back to the metallic form as the temperature rises. Silver tips are therefore self-cleaning. The use of silver tips is also advantageous in the case of contactors carrying heavy incandescent lamp loads in which the inrush current may be high enough to cause welding of copper contactor tips, especially if an oxide film has formed on them.

Overheating of contactor or solenoid operating coils may be caused by:

(a) Excessive voltage.

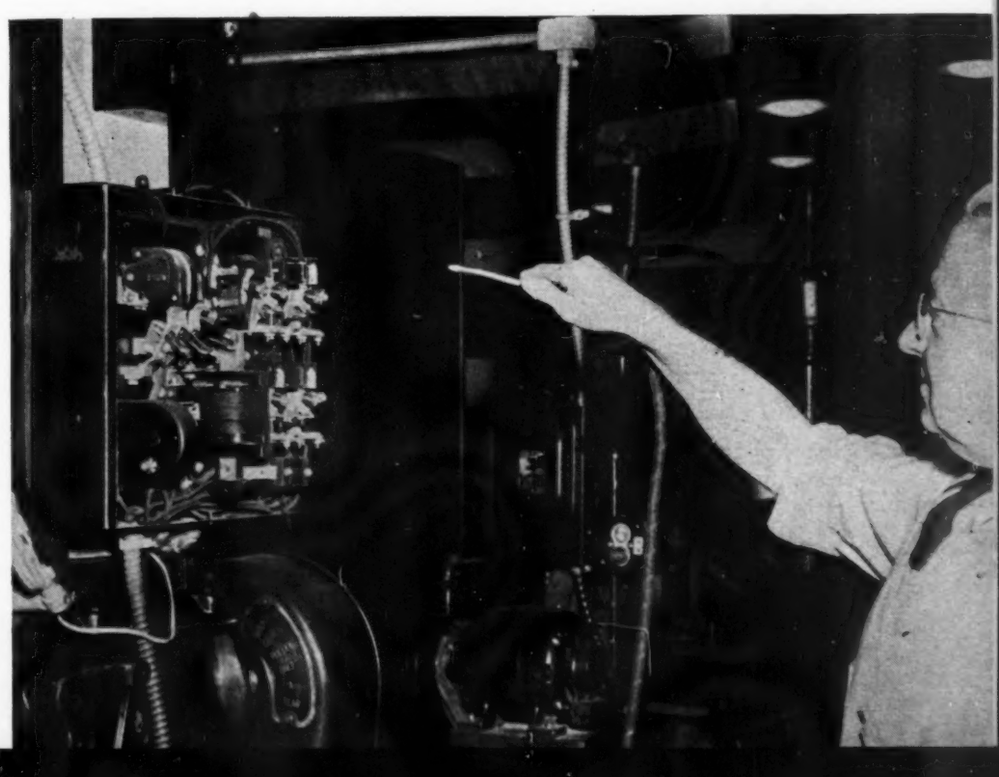
(b) Shorted turns in the coil.

(c) Improper coil, that is, one that is designed for another voltage or frequency.

(d) Failure of contactor armature to seat properly against the pole face, thus

[Continued on Page 118]

CONTROL EQUIPMENT *used for machine tools is subject to extra-heavy duty and should receive frequent inspection.*



# FROM LAND to S

BLUEPRINT SESSION—*W. S. Johnson (left) points out details of marine wiring to his sons Chad and Ted who are working for their dad on the ship wiring contracts.*

ENGINEER, *Gordon Adams, draws up detailed electrical plans from standard deck plans and the electrical specifications. Working drawings are made to one-quarter scale.*

WITH the advent of Pearl Harbor, a mild shipbuilding boom hit the Twin-Ports of Duluth, Minn., and Superior, Wis. Yards that were long idle began to spring into action. Some had been coasting along building pleasure craft; others were building barges. Now, all of them are working day and night building ships for Uncle Sam's Coast Guard and the Maritime Commission.

My first contact with this industry was as an electrical contractor called in to rewire the shipyards and to increase their electrical system capacity as they expanded; also to maintain the electrical systems in some of the yards. When they began to bid on government ships, our company was asked to submit figures on the electrical work involved in the ships. We were new at this type of ship work, but took a chance, worked up what we thought would be the right price and shot the figure. We were fortunate, for the yard we had quoted got a contract for a ship and we were ushered into the ship wiring field. Later they were awarded 12 more ships and we found ourselves in the thick of it.

From land to ship wiring in one big step—and what a step! I must admit we went into this with a bit of trepidation—for we were groping pretty much in the dark at first. We had only deck plans and Navy specifications to go by. Equipment locations were specified but we had to engineer all the circuiting. We were newcomers to the marine electrical field and we had almost all new men—so far as marine electrical wiring methods were concerned.

### The First Step

The best way to start out in a new field is to get first hand information about it. So we sent our estimator-engineer and our job foreman down to the shipyards at Manitowoc, Wis., for a week of study on ship wiring methods. Through previous arrangements they were escorted in and out of ships and shown the "whys and wherefores" of marine electrical wiring and systems. Now that we had a man in the shop and one in the field familiar with the new technique, we started in earnest.

Our engineer, Gordon Adams, began drawing up the wiring plans, using the Navy specifications and wiring instruction sheets as a guide. Motor sizes had to be secured from the equipment manufacturers; power and lighting circuits and feeders had to be calculated from the load; the number of lighting fixtures had to be determined from the foot-candle intensities outlined in the specifications. Reflectivity of the painted cork insulation in the rooms, low ceilings, beams and other obstructions in close quarters had to be considered in the lighting calculations. All circuits had to be identified in accordance with the specified marine circuit legend. The original $\frac{1}{8}$-in. scale deck plans were redrawn to $\frac{1}{4}$-in. scale and the electrical circuits shown; an isometric drawing of the ship's decks with electrical circuits and risers was also necessary.

The electrical systems installed included power for propulsion, power for winch motors and other motorized equipment, lighting systems, electrical cooking equipment, signal systems, degaussing system, underwater sound detector, radio, fire control, and intercommunicating telephone systems. All plans, feeder schedules and other pertinent data on the electrical system were sent to Washington for coordination with plans of other trades, to check on errors and omissions and for final approval. All plans had to be detailed and accurate since they were later reduced in size and included in an operating manual for each ship's crew. Once the plans were approved, it was a question of getting the material and making the installation. To date, copper cable has been the only serious material problem.

### Unfamiliar Methods

The actual wiring methods on board a ship vary considerably from those used in conventional building electrical installations. Conduit is used sparingly, generally for mechanical protection of the cables in the form of "kick pipes"—used wherever cables went through bulk-

# SHIP WIRING

**By W. S. Johnson,**
*Manager*
*Arrowhead Electric Co., Duluth, Minn..*

**How a Duluth electrical contractor made the transition from conventional electrical construction to ship wiring when a shipbuilding boom hit town. Now he has a business that dwarfs his regular contracting work.**

heads or decks. The wiring was confined almost entirely to marine type cable with a basket-weave metallic sheath. Cable brackets were welded to the ship's interior at frequent intervals and were of such design that the cable did not lay against the bulkhead or deck. Wherever a cable entered or left a junction box, controller, panel or motor, or kick pipe, stuffing tubes were installed to provide water-tight protection.

All of these methods were entirely new to the men on the job and they had to become familiar with them before they could make any appreciable headway. And working space on board ships is at a premium. So the men had to become accustomed to working efficiently in tight places with very little more than head or hand room.

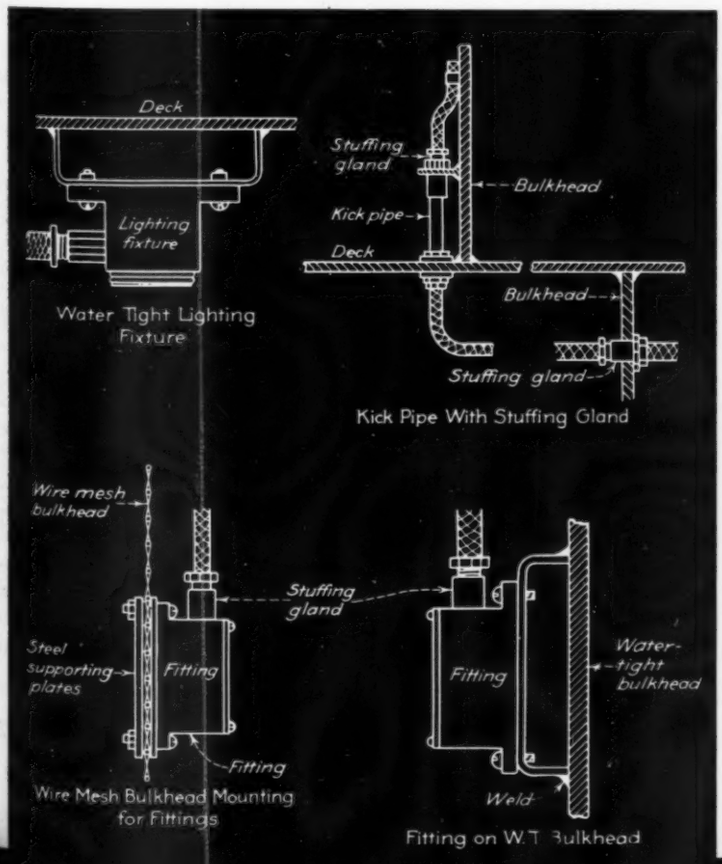
### Training New Men

If you were on board one of the ships we were wiring, you might be tempted to accuse us of loafing on the job. But, the men you saw were "new men" spending their first day with us strolling around the ship observing the wiring methods used, the solution to job condition problems encountered and, in general, getting the knack of things. New men were required to observe for a full day, then were assigned to work with an experienced crew the following day. Wasted time and money? No. We found that men who were initiated into marine wiring in this manner got a better background and learned faster. After working with a crew for a few days, they invariably were able to go on their own and were given more responsible tasks.

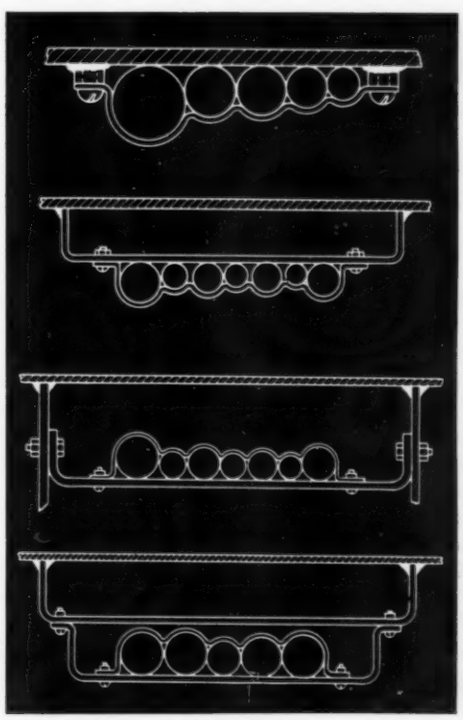
Some contractors prefer to train their new men in only one operation—putting it more or less on the assembly line basis. In our particular case, we found

[Continued on Page 69]

WIRING METHODS *on board ship are illustrated by these typical mountings for electrical fittings and method of protecting marine cable.*

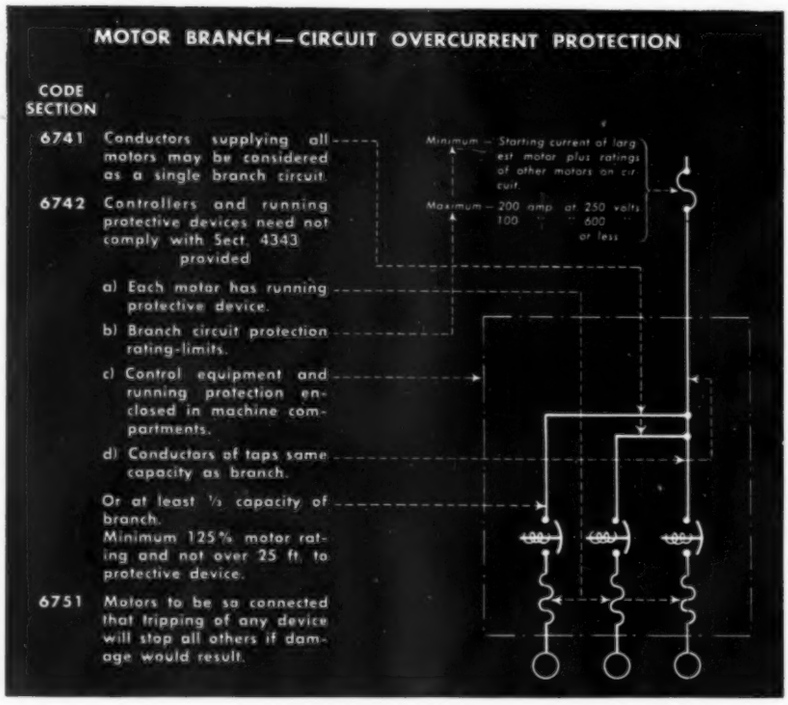



TYPICAL CABLE RACKS *illustrate the method of supporting electrical cables on ship wiring jobs. Welded supports are used extensively.*



# CODE RULES for MACHINES

**New rules for wiring machine tools issued in the 1940 Code Supplement line up manufacturers wiring with existing regulation.**


MOTOR BRANCH—CIRCUIT OVERCURRENT PROTECTION
CODE SECTION
6741 Conductors supplying all motors may be considered as a single branch circuit.
6742 Controllers and running protective devices need not comply with Sect. 4343 provided
a) Each motor has running protective device.
b) Branch circuit protection rating-limits.
c) Control equipment and running protection enclosed in machine compartments.
d) Conductors of taps same capacity as branch.
Or at least ⅓ capacity of branch.
Minimum 125% motor rating and not over 25 ft. to protective device.
6751 Motors to be so connected that tripping of any device will stop all others if damage would result.
Minimum — Starting current of largest motor plus ratings of other motors on circuit.
Maximum — 200 amp. at 250 volts
100 " 600 "
or less

**By John M. Turnbull**
*Service Engineer for the United Electric Light Company, Springfield, Mass.*

INTERIM Amendment No. 70, Article 670—Supplement to 1940 National Electrical Code on machine tools was approved by the Emergency Committee on August 4, 1942. Its rules are in addition to and amendments of other existing Code provisions.

These rules are stated to be in agreement with the American Standards Association on machine tools. The Code definition of a machine tool as given in the scope of the article is practically that used by the National Tool Builders Association.

Included in these new electrical rules is the basic consideration of having groups of motors under a single set of branch circuit protector devices. Section 6741 covers this. However, it should be noted that under Section 6742a each motor is required to have its own protection against overload.

These regulations provide for the installation of electrical apparatus within openings in machine frames or bases.

Section 6713 contains an important regulation requiring the use of nonmetallic cables to continuously moving parts, such as pieces of apparatus sliding on greased runways or rails. The absence of metal armor around cables connected to continuously moving parts should avoid the hazard of an insulation breakdown as might be caused by the breaking of the armor where it had been bent too often.

Regarding the color coding of conductors, this is still called for, (or else other distinctive means must be used) but it should be noted that no specific colors are referred to, except that green and white wires are to be employed only as "grounding" and "grounded" conductors respectively.

The wiring method to be employed is rigid conduit with a few exceptions. The limit of four bends to a run of conduit will not apply to machine tool wiring, provided conduit fill is reduced from the usual 40 percent to 30 percent.

Regarding grounding of slide parts, tests have shown that these may be considered as sufficiently well grounded as not to require separate bonds, provided, however, that such parts cannot readily be removed.

The universally successful application of synthetic insulation on machine tools has been recognized. The evidence is that this insulation provides a good answer to problems encountered where moisture and lubricants are present. Incidentally, the Code Supplement elsewhere in Amendment No. 46 approves the general use of type SN wire for new work.

This new article was the outcome of the work of a Technical Subcommittee of the Electrical Committee NFPA.

The importance of this new article should be apparent when it is remembered that the machine tool industry was the first to be called into war service and it has performed a most vital job. Whereas in an ordinary year this industry produced 25,000 machines, in 1941 its production went to 187,500. They adopted mass production methods. Now electrical equipment installation methods on machine tools have been standardized and brought into the National Electrical Code, an important step in advancing electrical safety.

**A limited number of reprints of John M. Turnbull's analysis of the 1940 Code Supplement including pages 25 to 30 of November and this article are available at ten cents each.**

## MACHINE TOOLS..National Electrical Code, Article 670 — Provisions for Equipment on Motor-Driven Fixed Metal-Working Machinery

### WIRING METHODS

**CODE SECTION**

**6711** Rigid Metal Conduit to be Used .....

Three Exceptions

**6712** 1. Flexible metal conduit may be applied for small or infrequent movements, and where not subject to oil or moisture. .....

**6713** 2. Cable of approved non-metallic-covered type to be used for continuously moving parts. .....

**6714** 3. Compartments and raceways within framework of machine may be used for conductors if entirely enclosed and isolated from liquid reservoirs

**6715** More than Four Bends per Run of Conduit O.K. Under Certain Conditions.

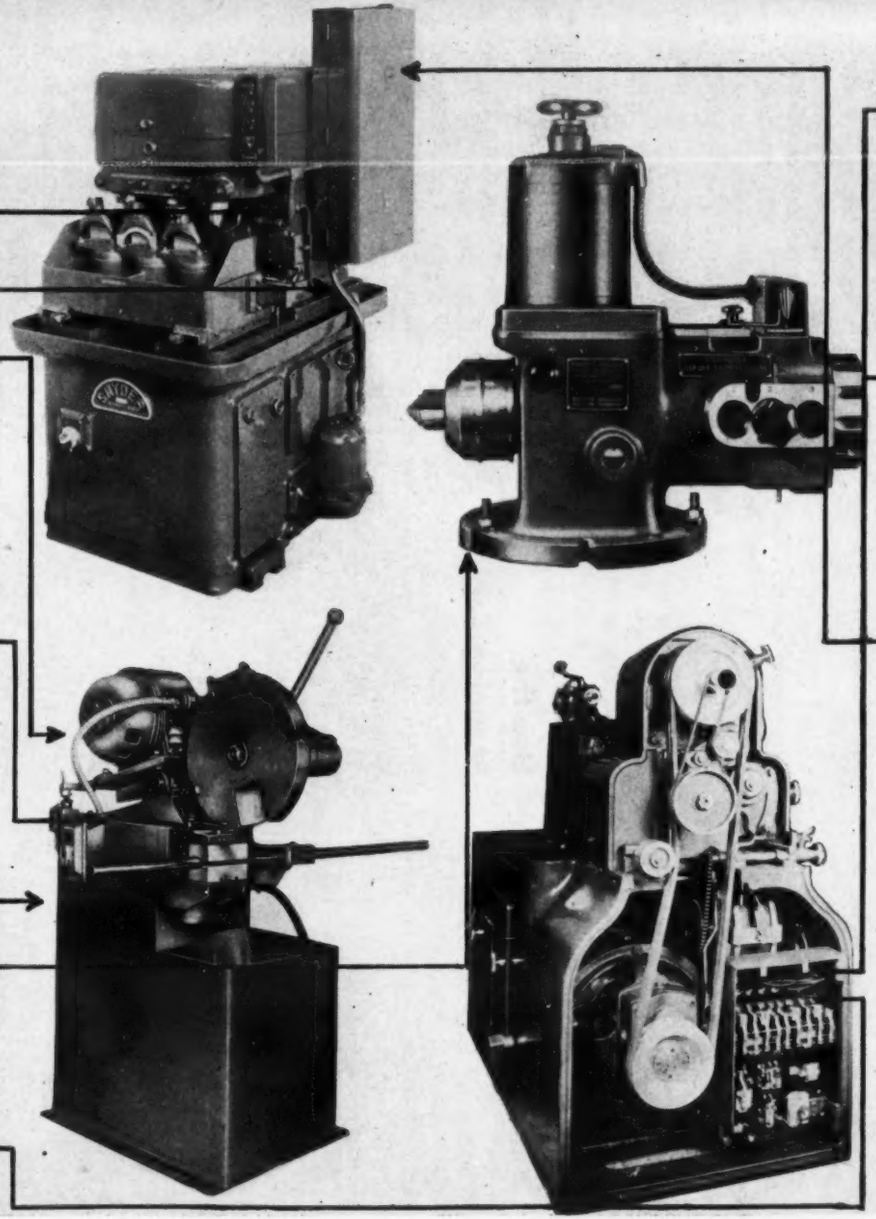
### GROUNDING

**6752** All Machine Tools, Including Connected Portable Equipment to be Grounded.

**6753** Guides or Ways Considered Grounded.

### CONDUCTORS

**6721** No. 14 Minimum, Except in Cables to Continuously Moving Parts.



### CONDUCTORS *Continued*

**CODE SECTION**

**6722** Conductors to be of Suitable Type

a) Type SN (Synthetic Insulation) to be used where subject to oil or coolant.

b) Cables to be oil and moisture resistant, with flame-retardant cover.

**6723** Identification to be Employed

a) White wire for grounded conductor.

b) Green wire as a grounding Conductor.

### CONTROL EQUIPMENT

**6731** Controller to be Free from Injury.

or

**6732** Compartments May be Used.

provided

a) Metal thickness meets requirements.

b) Covers are tight-fitting, hinged, secured in closed position.

c) Enclosures readily accessible, contain no moving machine parts, and free from oil, chips and the like.

d) Vented for group fusing.

e) Not open to floor or foundation.

## Is It a Contract?

The renegotiation clause which is written into every contract over $100,000 with the War and Navy Department is one of those wartime rules that is hard to support as either a war essential measure or good economics.

Practically, the contract arrangements between the government and the contractor affects the war effort only by providing a profit incentive and nailing down the responsibilities of each party. Whether the profit is modest or large is handled very strictly through taxation. Renegotiation, therefore, serves no purpose either in improved incentive or in any material cost reduction.

This is especially true in the construction industry. We went from a relatively modest business volume into a boom. Excess profit taxes are effective, consequently, on a large proportion of construction profits today. Therefore, from the government's position, contract prices today are little more than a bookkeeping amount for which it agrees to buy certain quantities of material, labor, services and pay a modest profit, retrieving any surplus through the tax window.

Renegotiation complicates the entire picture. Our whole social, legal and economic structure is based upon the binding contract. It is wholly proper to write in profit limitations or any other specific agreement as to terms and conditions, which, accepted by both parties, become binding. But under renegotiation the contract has become a one way document, binding upon the contractor but subject to alteration at the judgment of the buyer.

Unquestionably the intent of renegotiation is worthy. Its administration, on the whole, has been beyond reproach. Many of its original iniquities have been eliminated by amendment. But in less competent or sincere hands it could be an extremely dangerous instrument and an all-powerful political weapon.

It takes only a smattering of political realism to predict that some shrewd politician will one day lay down a new practical rule—"Let those who may be willing make our nation's contracts, so long as we can renegotiate them."

## Use the Manning Table

The latest step in providing for the deferment of key employees under Selective Service is the new Manning Table Plan. It puts the employer's requests on a solid factual basis.

If your organization is heavily engaged in war connected work, apply to the nearest regional office of the War Manpower Commission for Form 500. This is an application to be registered under the plan. The WMC office will then send you a form on which you report the different kinds of jobs in your shop and the length of time necessary to train each worker.

The report is then reviewed by the State Director of Selective Service. If it is accepted you receive a State acceptance number which permits you to use Form 42-A to request deferment of key employees.

The Manning Table Plan is not intended to provide exemptions from Selective Service. It is intended to provide for the orderly withdrawal of men in war essential occupations without crippling the organizations.

The plan is not compulsory, but it is in the interest of all firms engaged in war essential work to adopt it. It offers the best method so far developed for meshing the real needs of the armed services for skilled men with the essential requirements of industry.

## Motor Shops Help Production

Many motor repair shops today, in addition to their routine tasks, are doing manufacturing under subcontract to large equipment or arms manufacturers. A Davenport shop is making punches for a small arms ammunition plant; a Kansas City shop is manufacturing coils and assembling armatures for a large equipment manufacturer; other shops are turning out bearings and other small parts.

And so the list of items that such shops can make goes on and on. They have machine tools that are idle part time; skilled mechanics that can devote time to such production; and a knowledge of production technique and problems. They can do subcontracting work if they will make their facilities known to prime contractors and the WPB.

The part that each motor shop plays may seem insignificant when compared to large manufacturing units. But, multiply this small part by the hundreds of well equipped shops throughout the country—and there are several in each industrial area—and it will add up to a sizable lump of essential war production. There is a job for each shop, if it will only take the initiative to go out and get the work. And regardless of how small the job, every little bit counts.

## Progress On Chaos

We have been hearing some talk lately of a broad attack on the Code because it limits the development of substitutes and new wiring methods for the war. Besides that, it inhibits "progress".

Since the Emergency Committee has been acting with streamlined speed and efficiency to adjust code rules to the realities of war and material shortage and since many electrical inspectors have emergency authority to temporarily waive rules which might, in specific instances, hamper the war effort, we cannot appreciate this yearning for freedom from safety rules. We look upon it, as a matter of fact, with a somewhat jaundiced eye. What we hear now about the way the Code is inhibiting the conservation of critical materials bears a startling resemblance to the

arguments put forth years ago about how wiring cost too much because of excessive minimum standards.

Unfortunately, this attack will enjoy a lot of popular support. A set of rules developed to insure safety with generous supplies of metals and rubber available cannot be rigidly applied under our present conditions. By ignoring duration amendments it would be easy to build a strong case against the Code in wartime. And those who would defend it can be easily maneuvered into a position of appearing to obstruct the war effort.

Actually this program is not at all concerned with wartime wiring. Its proponents are looking ahead to post-war markets, to the old familiar objective of cheaper wiring installed with a minimum of skill. The elimination of the National Electrical Code would be essential to this kind of "progress" because safe wiring requires well designed, substantial materials installed with experienced skill.

## Use Caution On Underrating

Never before has the heat been on the electrical man as it is now. The design engineer, with business and government executives, has been collaborating in an excellent and extremely commendable program. He is urging that we take advantage of the service factor which is built into an electric motor to give that motor longer life and to protect it against unforeseen operating conditions, abnormal overloads, poor ventilation, and higher than usual ambient temperatures. They want us, as a war emergency measure, to deliberately use motors beyond their nameplate ratings.

However, if any one of these abnormal conditions prevail after the re-rating it might absorb all of this service or safety factor and more. Therefore it remains entirely up to us to make the decision as to horsepower ratings of motors to meet load requirements. This can be done intelligently only by investigating thoroughly all of the possible conditions under which a certain motor must operate.

For instance, take an unvarying load requiring 25 hp. in an environment where the air is cool, clean and plentiful. A 20 hp. motor might very nicely handle this load by taking advantage of the service factor. But, on a similar 25 hp. load which must operate down in a deep, dusty, hot pit somewhere in the vicinity of a furnace, it is a question whether a 25 hp. motor, even by taking advantage of its service factor, can operate satisfactorily without overheating.

Over-motoring wastes material. We must keep this uppermost in our minds. But under-motoring also wastes material, if it isn't handled with full regard for surrounding conditions.

Here is a challenge to every electrical man. He, and he alone, can navigate the safe course. The conservation of unknown quantities of material are his sole responsibility in this present emergency. We must get the greatest amount of good from what we have.

## It's Patriotic to Buy Tax Bonds

The tremendous publicity behind the War Bond drive has so overshadowed the Tax Bond that a word about the latter is in order, particularly for business organizations.

Surplus funds from the ordinary proceeds of business can and should be invested in War Savings Bonds whenever possible. But the ordinary small business does not accumulate surplus in this form. Such funds are either turned back into working capital, or distributed through dividends and bonuses.

Most well ordered business establishments, however, set up a reserve for taxes during the course of the year. This reserve is accumulated in cash in an ordinary commercial account. There it loses its identity as tax money and simply adds to the total of cash available for purchasing our dwindling supplies of goods, which in turn forces inflation.

If money set aside for taxes is promptly invested in Tax Anticipation Bonds, however, the Treasury gets the money at once and the asset does not contribute to the inflationary pressure of free cash seeking scarce goods.

Most banks handle Tax Anticipation Bonds without charge. Like War Bonds they increase in value and they may be used to pay Federal taxes at any time up to 1945.

So start today accumulating Tax Bonds both for your business and your personal account. It's patriotic and it's sound business.

## Thinner Tin

One of our most pressing problems in food packing was thrust upon us by the Japs. They cut off our principal supplies of tin. Yet no practical substitute for tin plate is suitable for canning some food products.

In ordinary tin plate production the tin was applied by dipping which used about three times as much as the minimum essential coating. To stretch our tin supplies an electrolytic process was used to deposit the tin in a thin layer.

But this isn't enough. Electrolytic deposits are not uniform. They form in minute hills and valleys. So the plate must be heated until the tin flows, evening out the layer. This is called brightening.

Out of the electrical industry has come a method of brightening that promises to revolutionize the manufacture of tin plate. A high frequency, applied to an induction heating coil through which the plate passes, heats it to the critical temperature necessary to permit the tin to flow. A photocell and an induction regulator provide automatic control allowing the plate to move through the heating coil at any speed.

Here is another example of electrical progress. Although induction heating, compared with a gas fired oven or other conventional measure of heating, is more expensive per BTU, it opens up the bottleneck of tin plate production. It permits continuous brightening at speeds which can be synchronized with rolling and electroplating.

In many applications of electric heating equipment, whether strip heaters, infra-red or induction, there is the typical engineer's concern with relative costs, electric against gas or steam or whatever method has been used. Yet there are many jobs where the convenience and adaptability of electric heating can open up production bottlenecks, avoid stacking materials between processes or straighten out production lines. In such instances the cost of the equipment or the power required becomes an almost insignificant factor.

# Methods

**BRIEF ARTICLES about practical methods of installing and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.**

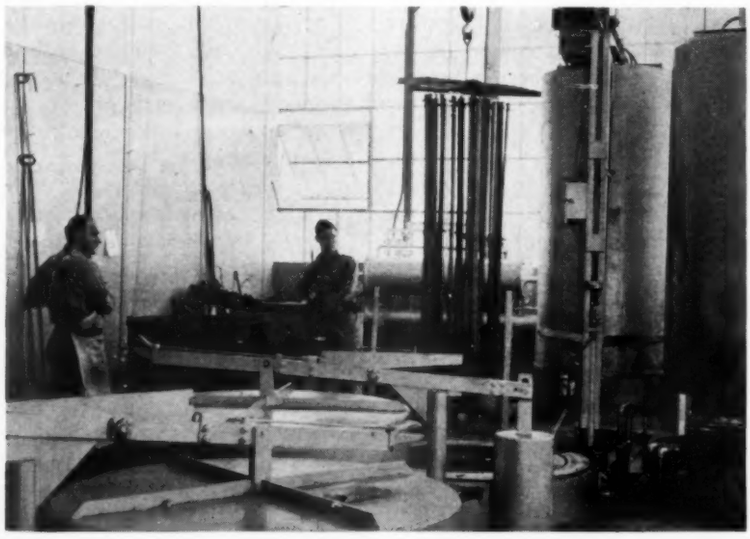
## HEAT-TREATING FOR ELASTICITY AND TOUGHNESS

INDUSTRIAL

In making parts both elastic and tough for use in the speedy Lockheed Interceptor planes, special care must be taken.

Menasco Manufacturing Company, to accomplish this job installed four G.E. electrical furnaces for hardening and drawing and a water-cooled oil quench. One of the greatest difficulties encountered was the excessive cooling of the parts in transferring from the furnace to the quench tank. By installing two quenching hoods on the furnaces to protect parts when moved, the problem was solved.

After the charge in the furnace is brought up to proper temperature, a hoist equipped with the hoods is brought over the furnace and the charge quickly brought in. The hood is then moved to the quench tank and the parts deposited into the oil. The transfer minimizes the cooling to a large extent, reducing warpage and scale accumulation on the thin-wall parts.



***ELECTRIC FURNACES** for heat treating tubular shaped parts. They have 30 in. inside diameter and are suitable for parts 60 in. long.*

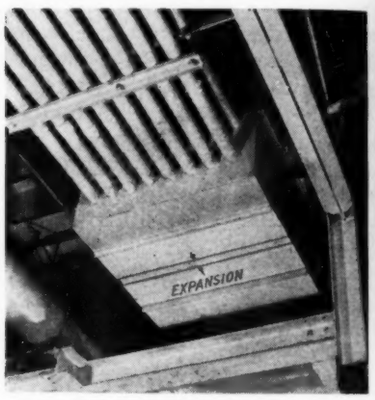
## EXPANSION PULL BOX

WIRING

The Associated Electric Construction Company, Melrose Park, Ill., joint venture electrical contractors on the Buick Aviation Engine Plant, encountered the problem of installing a double-tier run of 16, 3½-inch conduits past a building expansion joint. The use of expansion couplings would have been both expensive and difficult to install, since they would have had to be staggered.

To make a seemingly tough job easy, the company designed an expansion pull box that was easy to mount, served as a pull box in the run, and took care of the maximum possible expansion of the building and conduits. The box is constructed of 10 gauge steel; is 52-in. long, 54-in. wide, 24-in. deep, and is made in two sections which slide into each other. The sliding section is seven inches wide and is welded to one of the stationary sections. This will take care of the average expansion of four inches and still maintain a 3-inch overlap.

The entire bottom of the pull box, including the sliding section, is removable to provide access room for pulling in the numerous cables. The box is bolted to the steel I-beams by means of welded angle iron brackets. Two 45 degree flat iron brackets from each side of the beam web supports the overhang of the stationary sections of the unit. Ground jumpers maintain electrical continuity of the metallic ground.




***TELESCOPING PULL BOX** takes care of building and conduit expansion in this double-deck line of heavy conduits. Screw cover bottom provides access to entire box interior for pulling operations.*

## LETTERING ON DRAWINGS

OFFICE

Lettering on engineering drawings is essential to the finished job. It will enhance or detract from the appearance of the work depending on the proficiency with which it is executed.

Fast, symmetrical free-hand lettering, the good draftsman's stock-in-trade, is the result of many years of practice. Such draftsmen are hard to find today.

Therefore, mechanical means must be substituted wherever practical to obtain presentable and legible drawings. Use of mechanical guides is an excellent means of obtaining precision lettering, but is likely to be slow for general use.

A simple type of guide is illustrated

# UNITROL

REG. U. S. PAT. OFF.

## *Vital to Maximum Production*

**LET THIS TIME-SAVING, SPACE-SAVING, PRODUCTION-SAVING METHOD OF HOUSING AND CENTRALIZING MOTOR CONTROL SERVE YOU NOW**

Every moment of delay, every extra and unnecessary machining, assembling and installation operation, every unnecessary interruption to vital production, every diversion of manpower from production to maintenance now assume tremendous importance. They must be eliminated. That is why men responsible for the fate of America's production effort are turning to Unitrol . . . the modern and better way of housing, installing and centralizing Motor Control.

Whether it's Motor Control for a single machine or Motor Control for an entire factory, Unitrol makes the task of its installation, servicing, change, extension or contraction so much easier that plant after plant is adopting Unitrol.

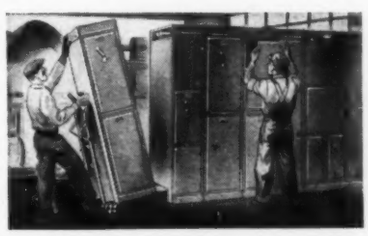
For those who don't know the many contributions of Unitrol to speed, space and production, there's the 32-page booklet "Unitrol . . . the next step forward in Motor Control progress" . . . free for the asking. Only, *ask for it now.* CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto.

**1892—1942 50TH ANNIVERSARY**

Unitrol is a *better* method of mounting, housing and *centralizing* Motor Control . . . from the individual unit up to the complete plant-serving motor control center. It is made up from standardized interchangeable parts. It is complete and usable at every step of the way. It is inexpensive, speedy and easy to install, demount or change. It is as "flexible as a rubber band."

The individual Unitrol *Section* houses Motor Control for several motors or motorized machines, is compact, space-saving, convenient and economical. No supports, no other structures or preparation necessary.

← The individual Unitrol mounting frame is *better* for machines with built-in Motor Control. It eliminates many machining, wiring and assembling operations.



The complete Unitrol Control Center houses all the control and control equipment in the plant, for easy, speedy man-power-saving installation, maintenance, change, expansion or curtailment. No wall or floor preparation. No racks, trellises or frames. Permits installation of more than double as much control in same space.

CUTLER-HAMMER
UNITROL
C-H

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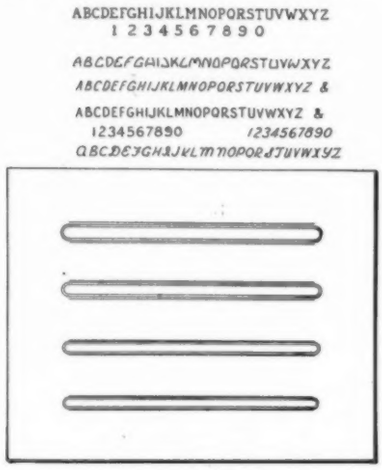
## Methods

[FROM PAGE 36]

here. It is semi-mechanical and employs fixed slots for controlling the height of letters. This guide may also be made in the form of an adjustable parallelogram from which a letter of any desired height may be obtained within the limits of the parallelogram side arms.

With the "slot type" guide no attempt is made to keep the vertical lines of each letter parallel. It is possible to keep the height of all letters equal by simply allowing the lettering medium to




***SLOT GUIDE** for lettering drawings speeds work, controls height of letters.*

strike the upper and lower limits of the slot in the guide, thereby keeping lines of lettering parallel.

Spacing between lines of lettering is obtained by the use of guide lines which are engraved above and below each slot on the guide, thus eliminating the use of guide lines on the drawing.

Character styles may be standard or individualized and are limited only by the imagination of the user. Some styles are shown here.

While this method does not produce the precision letters obtainable from totally mechanical guides, the final result is neat and workmanlike, and after a little practice the lettering speed is comparable to or faster than that obtained free-hand.

## REMOVABLE CABLE RACKS

WIRING

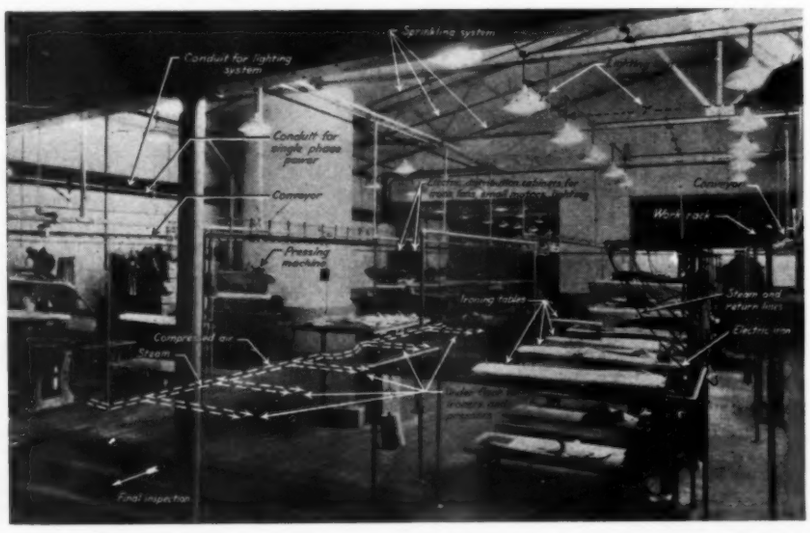
A right angle pullbox carrying conduit lines around a corner of the underground cable tunnel in the Buick Aviation Engine Plant provided an interesting problem of racking to keep the cables of various circuits separate and in line with the entering and outgoing conduits at three sides and the top of the box.

The Associated Electric Construction Company, Melrose Park, Ill., electrical contractors on the job, equipped the large pull box with two rows of angle iron cable supports that could be easily installed or removed after the cables were pulled into the box. Each support is made of a length of 2-in. by 2-in. angle iron, topped by an overlapping layer of $\frac{3}{8}$-in. insulating transite. The cable brackets are supported by flanges made from short pieces of channel iron welded to the inside of the box. To carry the cables around the corner, supports bridge the span formed at the "L" portion of the box.

***SLIP-IN BRACKETS**, seated in channel iron flanges on the inside of this right angle pull box, support the various cables which enter and leave the enclosure. Layers of transite, bolted to the supports, form the insulating medium.*

As soon as the cables in the top row of conduits were installed, the upper row of supports were placed in the box. After the lower cables were pulled in, the bottom row of supports were mounted simply by inserting one end of the angle bracket into the flange and pushing up the cables enough to allow the other end to be lifted over and dropped into the channel flange on the opposite side.

One valuable feature of this pull box was the forethought used in its design. Added depth was incorporated into the box although it was not needed at the time. Later, however, this additional area came in handy when additional conduits entered the box. No changes in the box dimensions were required. Now it serves as a 3-way pull box. A screw cover permits access to the box interior.




***"FREE-FLOW" OPERATION** is obtained by ingenious rearrangement of scattered equipment into straight-line production groups.*

## CONVEYORIZED OPERATIONS INCREASED PRODUCTION

INDUSTRIAL

Here is a worthwhile experience from a business whose daily volume varies greatly with the whim of the customer and the vagaries of the weather. The Kalamazoo Laundry Co., Kalamazoo, Mich., borrowed a conveyor application from the automobile industry for its pressing department. They knocked out the walls to rearrange scattered equipment into straight-line production groups and installed modern high-intensity lighting over each machine. Employee fatigue is greatly reduced, production has increased 40 percent, and quality is improved.

*ONLY AN ELECTRICAL WHOLESALER COULD THUS SPEED WAR PRODUCTION*

# WESCO made possible 15-day air-base miracle

***Products of 20 Suppliers and 40,000 ft. Lots of Wire and Cable Delivered on Time***

The new air-base site was weeds and sand, but Army employes were already en route there. In 2 weeks 70 buildings had to be built, made habitable and wired by the contractor. On Day 1 the nearest Wesco House shipped large preliminary supplies from stock.

Wesco placed orders with 20 suppliers for quantities of products—panelboards, boxes, plates, switches, clamps, fittings. Wire and cable were ordered in 40,000 ft. lots. Under Wesco direction, deliveries were so timed and co-ordinated that on Day 10 more than 60 buildings were fully erected and most of them wired. On deadline Day 15 the electrical contractor, his job completed, watched the air-base personnel march into their new quarters.

Wesco's stocks, buying sources and ability to expedite made certain the fulfillment of this task. It is one example, from scores, of Wesco's wartime service that speeds America's triumph. That service will be yours when Johnny comes marching home again.

**WESCO SPEEDS PRODUCTION**

* U. S. ammunition depot required lighting for urgent night-time operations, yet no wiring or electricity was allowed in building. Wesco engineer solved problem and met 3-week deadline.
* A steel plant urgently needed 18 different electrical products. Delivery promises by manufacturers ranged from 60 days to 9 months. Complete order delivered by Wesco in 3 days!

**WESCO SERVES BUSINESS**

* By offering prompt delivery of electrical items from large stocks.
* By maintaining perpetual inventory stock records.
* By providing trained sales and engineering personnel.

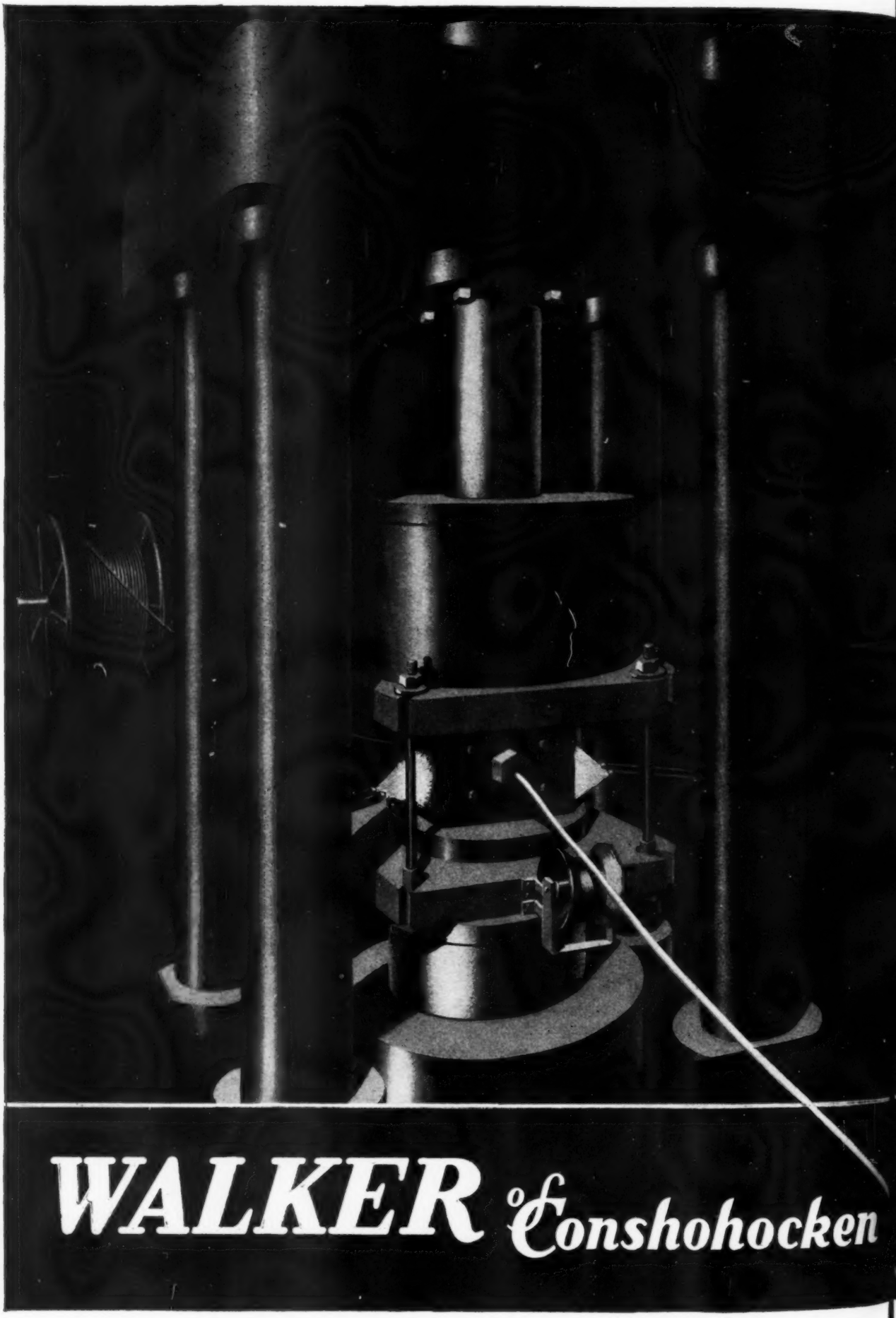
**Westinghouse**

**ELECTRIC SUPPLY CO.**

150 VARICK STREET · NEW YORK, N. Y.

*The name that means everything in electricity*

A NATIONAL DISTRIBUTING ORGANIZATION WITH 80 BRANCHES


WALKER of Conshohocken

# LOOK TO WALKER for LEAD COVERED CABLE

Today there is an ever increasing demand for lead covered cable. In defense plants—at air fields and supply bases—for ships in the maritime service—and in the manufacture of the *materiel* supplied to our fighting forces!

Our lead press equipment is running day and night to help supply these needs.

Investigate! Then—*turn to Walker for lead covered cable!* Get in touch with the local Walker distributor or talk with one of our field representatives. Walker Brothers, Conshohocken, Pa.

**Walker Lead Covered Cable**

Furnished in Solid Conductor from 18 gauge to 4 gauge and in Stranded Conductor from 14 gauge to 500,000 circular mils., with 1, 2, 3 and 4 conductors. Shipped on standard length reels of 500 feet minimum.

## Ten Ways in Which P.A.X is Helping to Speed War Production

1. Saves time for all employees. 2. Stops walking and "visiting". 3. Reduces errors and delays. 4. Gets and gives vital information quickly. 5. Co-ordinates work of all departments. 6. Increases efficiency of city telephone service. 7. Reduces city telephone costs. 8. Improves service to customers. 9. Ends congestion on city switchboard. 10. Improves executive supervision.

### Better Interior Communication —AND YOUR POSTWAR MARKET

This war is teaching American industry a lot . . . things that will prove vital when we return to peacetime competition. For instance, P-A-X automatic telephones are being used by the armed services to assure absolute co-ordination. And they're being used in hundreds of war production plants to save time, money and labor. In the post-war period, American industry will use better interior communication to maintain the pace set by war production and to meet the peacetime economy and its keener competition. This means a big market and a bigger opportunity for you "tomorrow." In helping to further the war effort, P-A-X is helping to speed the day when you will be able to supply the benefits of better interior telephone communication to every type of business.

AUTOMATIC ELECTRIC

Private Interior Telephone Systems

*Distributed by:*
American Automatic Electric Sales Company
1033 W. Van Buren Street, Chicago, Ill.
Sales and Service Offices in Principal Cities

*In Canada:*
Canadian Telephone & Supplies, Ltd.,
Toronto, Ont.


## Methods

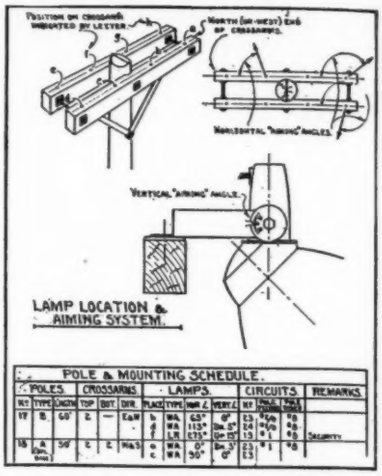
[FROM PAGE 38]

### LIGHTING A SHIPYARD

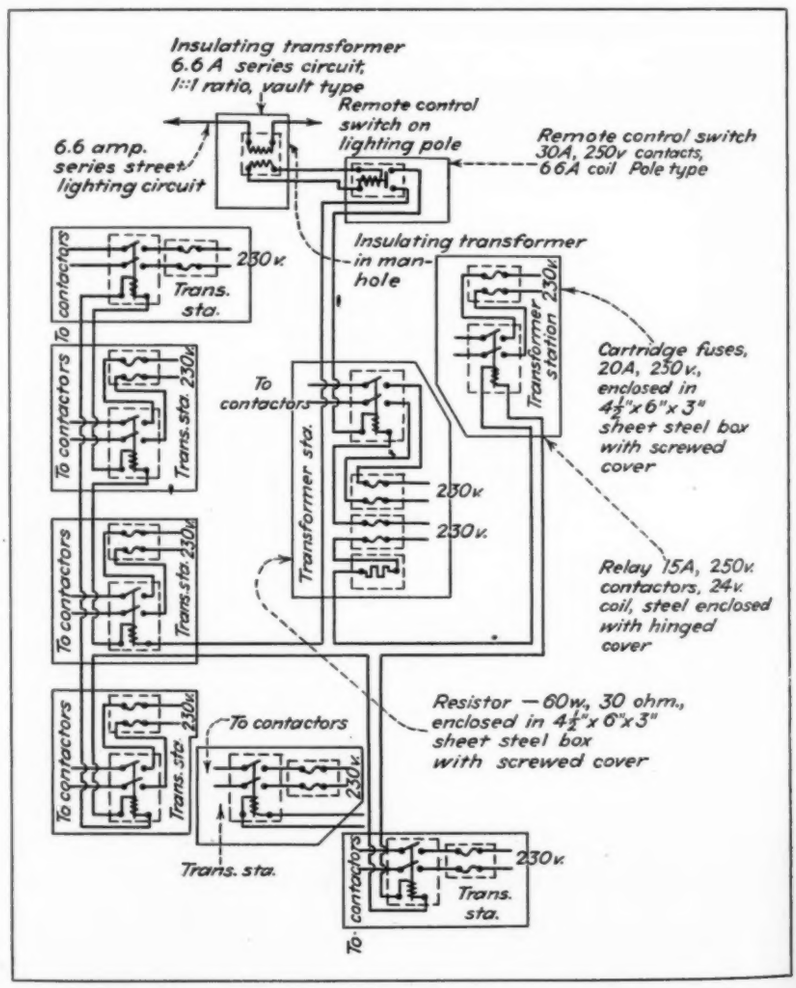
A lighting system for a shipyard must combine adequate illumination for safety and security, with higher intensities where needed for general ship construction activities. Such a system was designed for the Mare Island Navy yard by H. J. Prosser, electrical engineer of the Kaiser Co. Inc. The system was designed also to conserve critical materials and to provide serviceability, easy maintenance and economy. Particular attention was paid to transition from areas of high illumination to low-level areas and elimination of shadows in space devoted to detail work.

This was done by taking full advantage of the characteristics of the floodlights used and studying the permissible variations in lighting intensity within each area dictated by pole spacing and mounting height where crane swing or clear working areas were required.

Mounting was done on wooden poles with double crossarms 4 ft. long mounted usually 50 ft. above ground. Fourteen-inch or larger diameter butts, set 10 ft. deep, limit sway and provide sturdy mounting.




***POLE MOUNTING** for floodlights gives, in detail, the rigging data and points of attachment.*


Insulating transformer 6.6 A series circuit, 1:1 ratio, vault type
Remote control switch on lighting pole
6.6 amp. series street lighting circuit
Remote control switch 30A, 250v contacts, 6.6A coil Pole type
Insulating transformer in manhole
230v.
Trans. sta.
To contactors
Transformer station 230v.
Cartridge fuses, 20A, 250v., enclosed in 4½"x6"x3" sheet steel box with screwed cover
Transformer sta.
Relay 15A, 250v. contactors, 24v. coil, steel enclosed with hinged cover
Resistor —60w, 30 ohm., enclosed in 4½"x6"x3" sheet steel box with screwed cover

***CONTACTOR CIRCUITS** indicating the sequence of lighting control.*

FS-4NB for 40-watt lamps

G-E "MASTER NO BLINK"

FS-6NB for 100-watt lamps

# This NEW*
# FLUORESCENT STARTER
## Saves Time, Power and Materials

*It Saves Time*

**IT SAVES TIME** by allowing *instant dead lamp replacements.* It eliminates the "cooling" period required by automatic starters when a new lamp is being inserted in the fixture.

*It Saves Power*

**IT SAVES POWER** by eliminating *all* flow of current from the ballast under dead lamp conditions. The G-E "Master No Blink" does not require current to keep the dead lamp from blinking.

*It Saves Materials*

**IT SAVES MATERIALS** by reducing the number of replacement starters. The G-E "Master No Blink" will outlast all other fluorescent starters.

### THE FACTS ARE IN THIS MANUAL

**Full particulars—how the "Master No Blink" operates and how it saves you money—are in this new catalog on Fluorescent Accessories. You can get a copy by writing to Section GR-1222-8, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.**

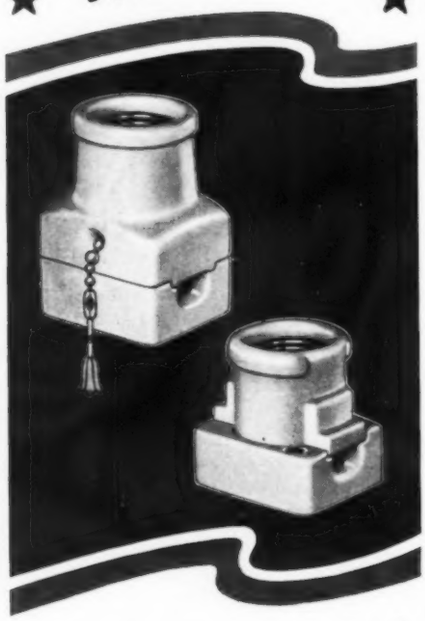
***A new product today can be justified only if it contributes directly to the war effort. That is the sole aim of the G-E "Master No Blink" Fluorescent Starter.**

**GENERAL ELECTRIC**

P&S

PORCELAIN
WIRING DEVICES

Save Critical Material



- Install P&S cablettes for a good wiring job with a minimum of critical materials.
- Easy to assemble and install —Designed for today's requirements.
- Available for prompt shipment.

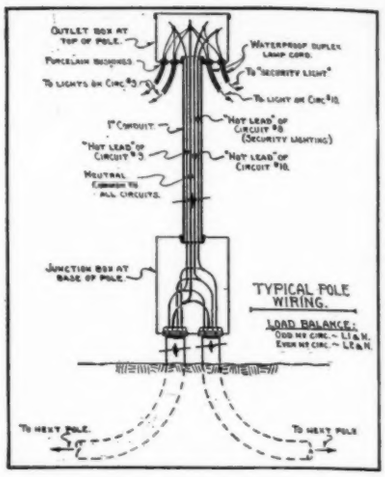
ELECTRICAL
Wiring Devices
SINCE 1890
PASS & SEYMOUR
INCORPORATED
SYRACUSE, N.Y.

## Methods

[FROM PAGE 42]

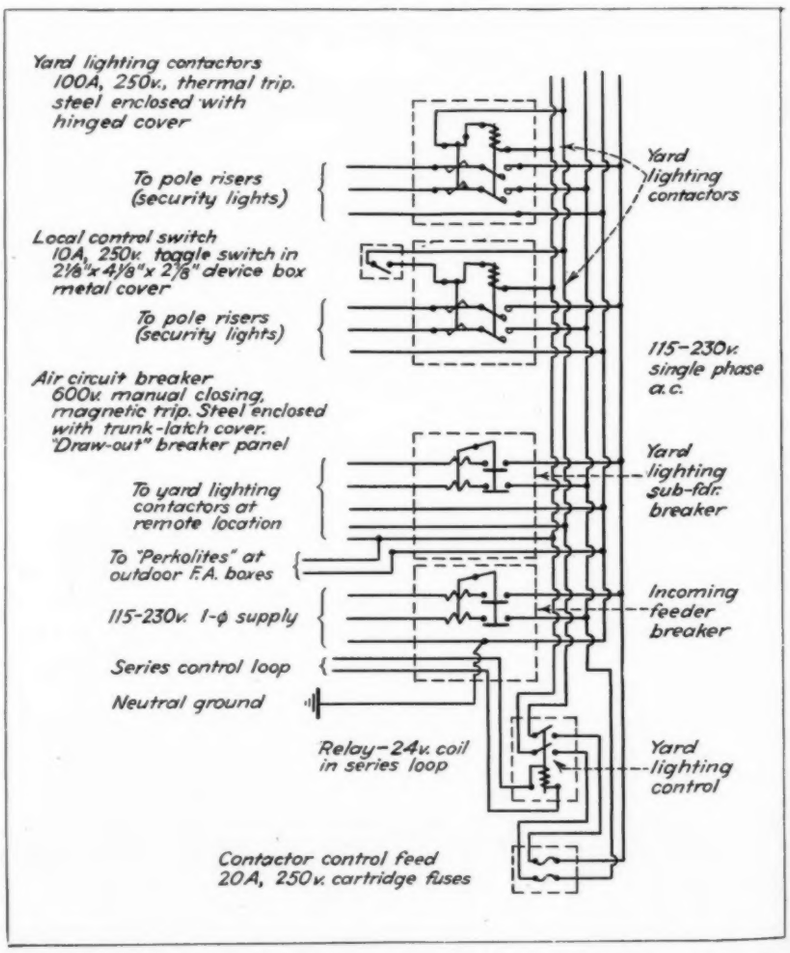
The short crossarms were chosen for minimum interference with crane swing and easily reached for maintenance. They hold from one to six floodlights per set depending on pointing angles. Where lights would interfere with one another or where more lights are required on a pole, the second pair of arms was installed 3 ft. below the first. Arms were pointed north and south or east and west to provide a broadside in the direction requiring the light with a clear side maintained where possible for climbing.

Location and aiming of lights was predetermined and scheduled on the design drawing. Horizontal angles were recorded and measured clockwise from north or west end of the crossarm. Vertical angles were given in degrees up or down using the quadrant and index built upon the supporting bracket and trunnion of the 1500-watt G-E floodlighting unit employed. All angles were given to the nearest 5 deg. This proved successful and the desired distribution of light was obtained without much final adjustment on the pole.


OUTLET BOX AT TOP OF POLE.
WATERPROOF DUPLEX LAMP CORD.
PORCELAIN BUSHINGS
TO "SECURITY LIGHT"
TO LIGHTS ON CIRC. #3
TO LIGHT ON CIRC. #10
1" CONDUIT
"HOT LEAD" OF CIRCUIT #8 (SECURITY LIGHTING)
"HOT LEAD" OF CIRCUIT #3
"HOT LEAD" OF CIRCUIT #10.
NEUTRAL COMMON TO ALL CIRCUITS.
JUNCTION BOX AT BASE OF POLE
TYPICAL POLE WIRING.
LOAD BALANCE:
ODD NO CIRC. ~ L1 & N.
EVEN NO CIRC. ~ L2 & N.
TO NEXT POLE.
TO NEXT POLE

***POLE RISER** details shows the method of connection between underground circuits and pole tap outlets.*

The lighting units use a standard 9½-in. light center length general service lamp. To obtain different beam widths, two types of reflector finish were used. Polished reflectors gave a 33 deg. beam for long range reach and etched reflectors 80 deg. beam for close-in spread.


Yard lighting contactors 100A, 250v., thermal trip. steel enclosed with hinged cover
To pole risers (security lights)
Yard lighting contactors
Local control switch 10A, 250v. toggle switch in 2⅛"x 4⅛"x 2⅜" device box metal cover
To pole risers (security lights)
115-230v. single phase a.c.
Air circuit breaker 600v. manual closing, magnetic trip. Steel enclosed with trunk-latch cover. "Draw-out" breaker panel
Yard lighting sub-fdr. breaker
To yard lighting contactors at remote location
To "Perkolites" at outdoor F.A. boxes
Incoming feeder breaker
115-230v. 1-ϕ supply
Series control loop
Neutral ground
Relay—24v. coil in series loop
Yard lighting control
Contactor control feed 20A, 250v. cartridge fuses

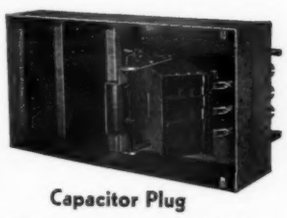
***FEED POINTS** on the lighting systems showing the connection to several points of supply.*

# It's all in the plugs

## FLEX-A-PLUGS COMPLETE the TRUMBULL ENCLOSED BUSBAR DISTRIBUTION SYSTEM

FULL benefits of this system, are dependent upon the wide variety and unique engineering features of FLEX-A-PLUGS that permit immediate connection or disconnection of motor driven machines at any point (12" centers) on the line.

### CONSERVE... ELECTRICITY BY CORRECTING POWER FACTOR AT POINT OF LOAD



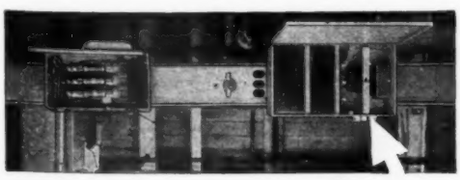
**Capacitor Plug**

Switch disconnect unit raised to show rear stab connections to busbars in Flex-A-Plugs.

Here, for the first time, is a practical and economical method of conserving electric power by correcting unsatisfactory power factor conditions right at the point of load. **Trumbull Capacitor Plugs,** containing a **G-E Pyranol Capacitor** and switching or circuit breaker disconnects, can be plugged into a Flex-A-Power run at any point along the line.

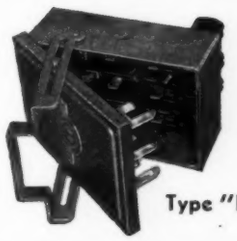
***A maximum saving in power*** can thus be achieved by installing properly rated correction units wherever poor power factor loads are located. If machines are moved or load conditions vary, the Trumbull Capacitor Plugs may be quickly relocated to meet the new load requirements.

For complete information about Flex-A-Plugs and the entire Trumbull Enclosed Busbar Distribution Systems, write for Trumbull Bulletin 408.



Capacitor Plug Circuit Breaker Disconnect.

### CONNECT... MACHINES IN A MATTER OF MINUTES



Flex-A-Plugs, with "stab" connections to buses, simply plug into Flex-A-Power runs at intervals of 12" or more.

**Type "F. L."**

### PROTECT... WITH FUSED SWITCHES RATED IN HORSEPOWER OR CIRCUIT BREAKERS

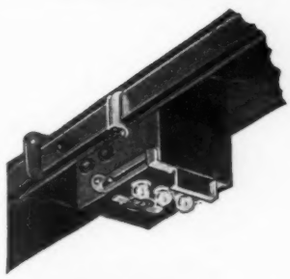
**Type "F. E."**

Type "F. E." Flex-A-Plugs have Trumbull Type "AT" Automatic Circuit Breaker Mechanism providing automatic over current and short circuit protection.

Type "F. D." plugs contain Type "RBA" heavy duty motor circuit safety switch mechanism.

Type "F. L." plugs with cam operated cover have double break switch mechanism with fuses accessible only when fully disconnected.

### INDICATE... PHASE FAILURE IMMEDIATELY



Neutralizer Flex-A-Plugs, installed at ends of branch circuits, protect against voltage build-up in secondary and give instant visual indication of phase failure.

## THE TRUMBULL ELECTRIC MANUFACTURING COMPANY

PLAINVILLE, CONN.

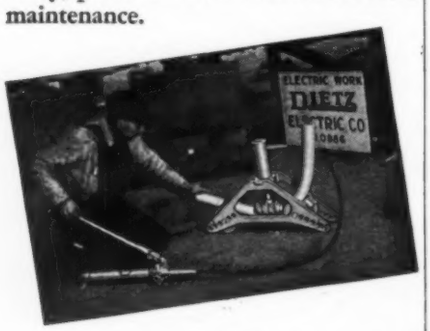
THE TRUMBULL ELEC. MFG. CO. — PLAINVILLE CONN. U.S.A.

OTHER FACTORIES AT NORWOOD (CINN.) O. — SEATTLE — SAN FRANCISCO — LOS ANGELES

# The HEART of a PIPE BENDER

is its POWER UNIT!

**Pipe Benders have generally depended on hydraulic power from self-contained, "one-purpose" jacks that work only in limited positions. Blackhawk Benders are different — they have *Porto-Power Hydraulic Units*—hence, operation at any angle, light weight and extra utility. These same Porto-Power Units are widely used in many fields and are the only perfected equipment of their kind! Blackhawk is a specialist in building hydraulic equipment — and Porto-Powers are famous for their dependability, performance and freedom from maintenance.**




**Blackhawk Pipe Benders bend rigid conduit and pipe up to 4" diameter smoothly and without kinking. Save need for elbows, couplings, cutting and threading. Portable — lightweight — can be carried or rolled to the job and operated by one man to speed up construction and changeovers.**

**MAIL COUPON TODAY**

**BLACKHAWK MFG. COMPANY**
**Dept. P20122, Milwaukee, Wis.**

**Send Full Information on your Pipe Benders.**

**Name**.....

**Company**.....

**Address**.....


## Methods

[FROM PAGE 44]

Each unit was connected to the circuit by a flexible cord from a common outlet box at the top of the pole. Poles were located near manholes in the underground distribution system and served from buried conduit risers. Lines of poles adjacent to buildings were connected through service heads to conduits run along the eave strut.

Power supply came from local distribution transformers at various lighting feed points. Switching was accomplished by 28 100-amp. magnetic contactors. To relay the control, a series loop of eight low-voltage relays operate the coils of the 100-amp. magnetic contacts. The series loop in turn was controlled by a street lighting multiple control switch energized by the nearby series street lighting circuit through an insulating transformer.

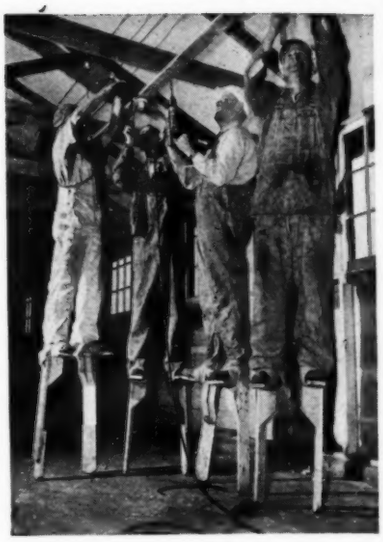
With such an arrangement central control came from the street lighting system, preventing daytime burning and insuring satisfactory emergency blackout. The low-voltage relay loop has the advantages of series control without the hazards of high voltage or requirement of special equipment.

For local control, lamp switches placed in the operating coil circuit at certain contactors affords a limited local switching of lights fed through these contactors. However, they will not burn when the street lights are out. Other lights fed through contactors without local switches are designated as security lights and burn whenever the street lights are on. The latter lights are selected to provide an average intensity of 0.1 ft.-candle in less important areas to 2 ft-candles in transition areas near entrances to brightly lighted shops. Local control lights raise such intensities to 3.5 ft.-candles at points of detail work tapering out to 1.5-ft. candles in adjoining runways. Provision has also been made for portable lighting to give higher intensities.

## MECHANICS ON STILTS

WIRING

Jumping up and down ladders and moving them from place to place involves an immense amount of wasted time and energy. Scaffolding, also, in a great number of instances is either inadvisable with respect to the short working time in any one given spot or inefficient, due to the short distance of required elevation.



***GIANTS** are made not born.*

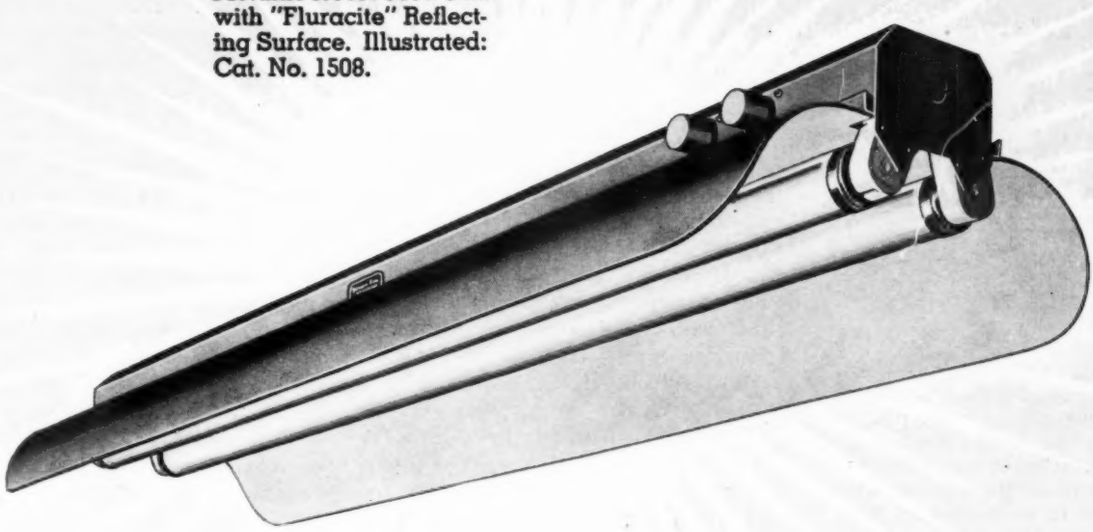
Step-ladders had previously been used by the men to raise themselves several feet off the floor to reach their work. Scaffolding was out of the question in that they moved too fast, so someone devised the scheme of using stilts. It was given a fair trial which proved satisfactory to both the men and the supervision, and was adopted thereafter as the procedure for overhead wiring.

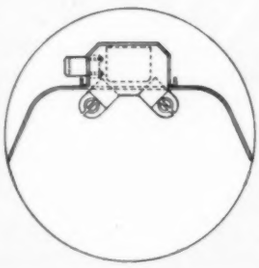
This shot was snapped of the electricians of the Electric Construction Company at work in one of the Fort Lewis, Washington messhalls. The workmen pronounced the stilts very much "okay" but said their feet felt "funny" when coming back down to good earth again.

It was proven by timing that the "stilt gang" could far out-run the "step-ladder gang" and in much less time.

***IMMEDIATELY** above the porcelain crocks which contain sulphuric, nitric and hydrochloric acids used in cleaning scale from metal, prior to brass plating, are a series of slots in a ventilating hood. Through these slots, noxious fumes are instantly exhausted by an Ilg direct connected universal blower. This unit, operating at 685 rpm. delivers 8250 cfm. at 1 in. static pressure. Mounted overhead, no valuable floor space is wasted.*

Curtis "Fluratex" Non-Metallic Reflector Unit with "Fluracite" Reflecting Surface. Illustrated: Cat. No. 1508.





# FLURACITE

## REFLECTING SURFACE

### For Long-Lasting, High Efficiency

**GUARANTEED NOT TO DETERIORATE IN USE**

"Fluracite" Reflecting surface has been used with extreme success on Curtis Fluorescent Lighting equipment. If at any time the surface is found to deteriorate under proper use, it will be refinished without charge.

*High Efficiency.* "Fluracite" possesses unusually high reflectivity.

*Glossy White—No change in color.*

*Easily, Safely Cleaned* with soap and water or any non-abrasive cleaning compound.

*Not Affected by Acid Fumes.*

*Tough, Elastic. Resists Peeling and Checking.*

*Especially Suited to Curtis Non-Metallic Fluorescent reflectors.*

For America's biggest job, industry seeks assurance of the best in fluorescent lighting. Many of the finest recent installations utilize "Fluracite," the reflecting surface with these superior qualities:

"Fluracite" stays white. It will not change color under normal use. It is a tough, mineral-hard surface maintaining extremely high efficiency. This baked synthetic reflecting surface has been proven by successful use on Curtis Fluorescent units for four years.

"Fluracite" is especially well suited to the following Curtis Industrial units with chip-proof non-metallic "Fluratex" reflectors:

No. 1506 for two 40 watt fluorescent lamps "with provision for installation of a third lamp at any time." No. 1507 for three 40 watt lamps. No. 1508 for two 100 watt lamps. It will pay to call in the Curtis representative on your next industrial lighting problem.

**Send for It!**

Now available to the electrical trade is "Curtis Lighting for Vital Industry," a booklet which describes our newest, most efficient equipment for any industrial lighting requirement, including powerful silver mirror glass reflectors for use with incandescent lamps. Send for your copy—on your letterhead—TODAY.

# CURTIS LIGHTING, INC.

6135 W. 65TH STREET • CHICAGO

## We're All-Out for War Production

Every day the problem of filling our customers' orders, with anywhere near our former facility, is becoming increasingly difficult. It's not necessary for us to explain the complexities involved in participating in a war production program, because we're all familiar with such terms as "on the critical list" and "priority control.'

McGILL products and those of its material suppliers are subject to these restrictions and the annoying but unavoidable delays that accompany them.

The McGILL organization is exerting every possible effort to meet the new exigencies of this critical period. Your orders, received today, are getting just as sincere attention as they did only a short time back when our major problem was to keep the plant operating.

**McGILL Products Are Used By the Following:**

United States Army
United States Navy
Maritime Commission
Procurement Division
Aviation Corps
Machine Builders and
Makers of War Products

Levolier Switches and Lamp Guards are available on priority orders.

*Electrical Division*

McGILL

MANUFACTURING COMPANY, INC.
VALPARAISO, INDIANA


## Protect Your Business Security

[FROM PAGE 26]

where you are making or losing money. How much did you make on sales of wiring jobs? Is your lighting business profitable? What was the monthly net on service? Too many contractors lump their sales, are satisfied if the business made a profit on total volume and never know which lines or departments are strong or weak. The overhead should be pro-rated to the various lines in accordance with sales volume and when this is done, it may show that a line that has always seemed profitable because margins were long is a bit on the cloudy side.

Harper makes a good margin and should net more than two percent on sales, even in these days when profits are restricted. If your net profit is too low, despite satisfactory margins, your overhead is too high and you should lop off expenses wherever you can or increase sales to reduce the overhead ratio to sales. We know that this is easier said than done in many cases but these suggestions are your only avenue of escape from loss. Even in calmer days, business research specialists stated that their surveys showed invariably that profits were due more to the rigid control of expenses than to brilliant sales strategy and this is more likely today when margins and sales have been restricted by wartime controls. The hallmark of the capable contractor for the duration is expense control. List all expenses individually and compare each item, month by month, to note the trend, also make comparison with your experience figures for the past three years. Don't increase your fixed charges, if you can help it. Fixed expense can't be cut so readily.

Analysis may show that an expense is too low. For example, Harper spent less than one-fifth of one percent in October for advertising, obviously too low, if indicative of the yearly ratio. There is a dangerous tendency at a time like this to ask, "What's the good of spending money for ads when we can't handle the business coming in or can't get the materials to do jobs?" This is a sophistry. Keep advertising output up to standard. You will need the goodwill it stores up when the war is over.

Interest paid — $100 — indicates loans payable of $20,000 at prevailing rate of 6 percent yearly—not too high on current loans for a business this size. Administrative expense of $2,400, around 10 percent, is about right and contractors should not exceed it. Non-productive labor is too high—about four percent on sales. This expense, unless watched carefully, will rise with the duration. Excessive waiting for hard-to-get items and the tendency for labor to slow down because manpower is scarce will kite non-productive labor these days. Watch this account with falcon eye.

Collection expense—$250—1 percent on sales—indicates lax credits and too many "poor pays" on the books. Give credit with care these days. Harper should also check back on his depreciation expenses to determine whether the charges are adequate, otherwise, his profit computation may be wrong. "Miscellaneous expense" is too high, indicating that it is used as a dumping ground for many accounts that could be classified separately to give a better picture of operations or charged to existing accounts.

Inasmuch as the margin seems ample, it is Harper's best bet to check back carefully on all overhead expenses. If the margin was too low, his first step would be to pore over his estimates and job costs on completed work, making comparisons to see why his cost of sales was too high. Price control prevents him from boosting prices to take up any slack so it is largely through keen detective work of this sort that the contractor can purge his business of undesirable elements that are picking his pockets.

You are the best judge of the net profit you think satisfactory but we suggest that you be very conservative these days. We have checked figures in pre-war times where only four out of 11 concerns made a net profit over five percent and we have checked figures in this field that varied from a two percent loss to 11 percent profit for the same type establishment, and when we checked behind these figures, we invariably found that the big money-makers were those contractors who put their profit and loss statements under the microscope monthly. If you net four percent today after deducting remuneration for your own services, interest on investment and the various allowances for bad debts and depreciation, you may consider yourself a competent business manager.

In the final analysis, remember that the sales figure is not the true index to net profit and never was. Even though your sales volume is curtailed, you stand a good chance of pulling through the war period with something in the till if you watch your costs with falcon eye through the medium of profit and loss analysis.

# "Skilled Lighting"

## Gives the Answer!

***Wheeler's new "War-Aid" RLM Fluorescent Fixtures retain top efficiency with Non-Metal Construction!***

No longer is there any need to worry about continued supplies of high-economy, production-boosting fluorescent fixtures for war plants! Wheeler *Skilled Lighting* now includes new "War-Aid" Fluorescent Fixtures made with a minimum of hard-to-get sheet metal. What's more, all the lighting efficiency of previous models is retained!

### New Non-Metallic Reflectors

Reflectors are made from a rugged, non-flammable, moisture-resistant non-Metallic material. Reflecting surfaces of chip-proof, washable baked enamel have an enduring reflection factor of not less than 84% ... provide minimum overall efficiency of 80% in 48" 2-lamp units, 73% in 3-lamp units and 73% in 60" 2-lamp units.

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Wheeler RLM Fluorescent Fixtures are available for Individual or Continuous Run installations. Only a few extra parts are required to convert units into continuous installations of any number of units desired.

### Get Complete Data

Write for full details of Wheeler Non-Metallic Fluorescent Fixtures and complete catalog of Wheeler Incandescent Fixtures. **Wheeler Reflector Co., 275 Congress Street, Boston, Mass.** – New York – Cleveland. Representatives in principal cities.

**DISTRIBUTED EXCLUSIVELY THROUGH ELECTRICAL WHOLESALERS**

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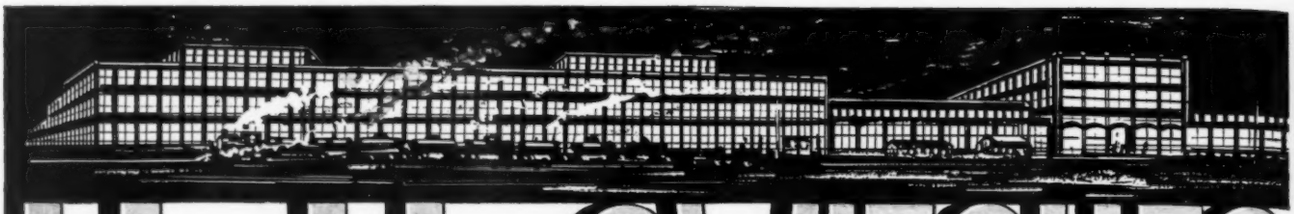
- New Non-Metallic reflectors ... sturdy, non-flammable, moisture-resistant.
- Chip-proof baked enamel finish ... grey outside, permanent washable white reflecting surfaces.
- Provide full power-economy of fluorescent lamps, and undiminished overall lighting efficiency.
- Made for two or three 40-watt lamps, or two 100-watt lamps; in types for individual or continuous run installations.
- Reflector can be separated from wiring channel by loosening two thumb screws. Chain hangers prevent reflector body from dropping to floor. This feature permits quick and easy access to all operating equipment which is installed in wiring channel.
- No loose parts such as bolts, screws or nuts to handle.
- Fixtures can be mounted from chain, conduit, close to the ceiling, or can be provided with new "C" Clamp Slide Hanger.
- Design approved by Bureau of Standards. Performance guaranteed by RLM Standards Institute.

**Wheeler REFLECTOR COMPANY**

LIGHTING EQUIPMENT SPECIALISTS SINCE 1881



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## UPHOLD PLANT MAINTENANCE

*DIVERSITY* of types meets "current" needs for new construction, conversion *or* replacements. Heavy-duty controls for lighting or power circuits:—specification-grade T-rated 10, 20 and 30 Ampere "Type C" Switches, Rotary Snap Switches, Ceiling Pull Switches, Door Switches, Flush Tumbler Switches with or without outlet box covers.

*DEPENDABILITY* of mechanisms meets war demands for uninterrupted service on critical jobs. For more than a half-century, H & H Switches have been *tested-by-use* for emergency conditions now general. Among the first in the field, they were long since promoted to the "ranking line" for under-fire assignments the world over.

HART & HEGEMAN DIVISION
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ENGINEERING · INSTALLATION · MAINTENANCE

## ALERTS

UNDER the limitation imposed by the War Production Board and the local rulings of officials of the Office of Civilian Defense there are no universal specifications for preparing industrial plants and essential civil buildings for blackouts. Shortages of materials and special equipment require extraordinary ingenuity in meeting the needs of darkened aerial objectives.

The plans should be drawn and the preparations made now. Actual blackout screening or reduced emergency lighting levels can be installed when and as authorized. The most critical items involved will be electrical wiring materials and ventilating equipment. Considerable economies can be effected by preliminary planning to the end of maximum effectiveness with a minimum of scarce materials.

Blackout preparations cover many plant activities other than electrical work, however, the burden of the job is usually electrical. In most plants the responsibility for blackout preparations will fall upon the electrical staff. In any case the preparations should be thoroughly coordinated with the plant defense organization.

Previous articles covered—

Eliminating Causes of Severe Service Conditions
Providing Adequate Capacity for Increased Demand
Electrifying Operations to Reduce Unit Costs
Safety Protection for Electrical Operations
Increasing Flexibility of Electrical Service
Electrical Aids to Automatic Control
Electrical Ways to Reduce Waste
How to Save Power
Protection Against Sabotage
Improving Working Conditions
Electrifying for Continuous Operation
Electrified Plant Housekeeping
Electrical Problems Under 168 Hour Schedules
Electrical Aids to Plant Conversion
Electrical Aids to Quality Control
Electrical Aids for Green Help
Codes in Wartime
Grounding for Safety
Air Raid Restoration
Operating Replacements
Preparing for Blackouts (this issue)

Future articles will discuss—

Wiring for Quick Changes
Welding in Industry
Salvaging Electrical Equipment

# PREPARING FOR BLACKOUTS

THE purpose of a blackout from a military viewpoint is to obscure vital objectives from the enemy. Industrial preparation for blackouts, calls for the elimination of all light radiation with the smallest reduction in plant output and the use of the least amount of critical materials for this purpose.

### General Conditions

For blackout purposes, the country may be considered to have two types of areas. The first type will be those areas considered to be within striking distance for some consistency of action by the enemy. Here, nightly dusk-to-dawn blackouts may be ordered during periods of emergency.

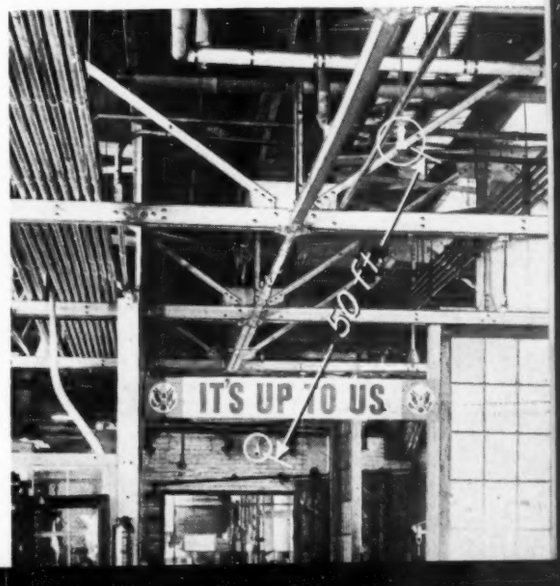
The second type will be those more distant areas which could only be subjected to occasional "token" or "suicidal" raids. We have been warned that Detroit, for instance, is not beyond the range of such bombing. Here blackouts presumably will be in effect only during the period of the alert. The number of such raids we can now expect appear to be few. Of most immediate concern, however, is the probable requirement for plants to blackout during test air raids.

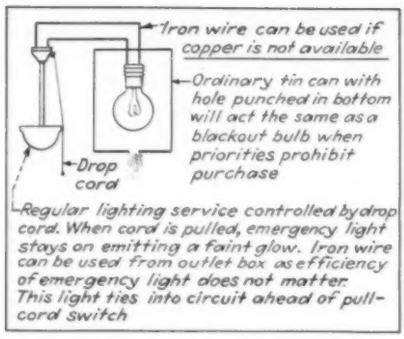
Preparations to insure a minimum loss of production while using the least amount of critical materials will be quite different in plants in the two types of areas. Definite plans should be set up so that when appropriate official orders are received, no unnecessary delays will occur. We may assume that when orders are given, the authorities will believe danger is imminent.

Plants in the first type area should plan to so protect and obscure their grounds and buildings that production will not be interrupted because of the blackout. Methods of obscuration of lighting have been adequately and officially described in a booklet called "Blackouts" issued by the Office of Civilian Defense. Lighting equipment which may be used in unobscured portions is covered by official specifications developed by the Engineer Board, U. S. Army. These were printed in detail in the July 1942 issue of *Electrical Contracting*. Emphasis on planning only is indicated by present rulings that War Dept. standard, interior or street blackout units may be secured only on priority ratings higher than A-2. It is doubtful whether approval could be secured to purchase these units except in the exposed "Passive Protective Areas" which have not as yet been defined.

Plans for obscuration of lighting should be kept flexible as the list of critical materials is expanding and changing. For example, wood products are becoming more difficult to obtain,

***BLACKOUT** lamps in an evacuation aisle are spaced on 50-foot centers wired into signal circuit connected ahead of the main switch.*




Iron wire can be used if copper is not available
Ordinary tin can with hole punched in bottom will act the same as a blackout bulb when priorities prohibit purchase
Drop cord
Regular lighting service controlled by drop cord. When cord is pulled, emergency light stays on emitting a faint glow. Iron wire can be used from outlet box as efficiency of emergency light does not matter. This light ties into circuit ahead of pull-cord switch

while paper and corrugated board are today much more plentiful than they were several months ago. Corrugated board would have the advantage of being light in weight, of having some inherent structural strength, of being relatively inexpensive to replace in case of damage, and of being dull surfaced and opaque without being black. The choice of material to be used for blackout screens may be restricted, but it now seems that dull surface, opaqueness, and resilience are the necessary characteristics. The purpose is to prevent light radiation even though concussion may break the windows.

Obscuration screens should be designed to require the smallest amount of time and labor for erection. Screens which may be prefabricated should receive preference. Blackout screens which are almost extra walls and roof have little to justify their cost for no screen will maintain blackout against direct hits or near misses.

The extent to which screens of black marquisette or "Ninon" may be used during blackout has not been stated. They have been effective in dim-out, for the light on adjacent horizontal surfaces has been reduced by as much as 75 per cent. If no vertical surfaces are present to reflect horizontal light rays, use of such material may be permitted. Loose weave material which will cut off angular light rays would have an advantage in permitting some natural ventilation. It is advisable, however, to make no purchases of such materials for blackout use until specific approval has been secured.

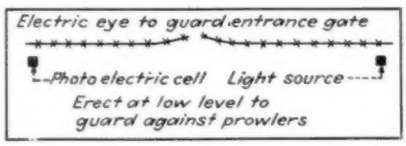
### Lighting and Color

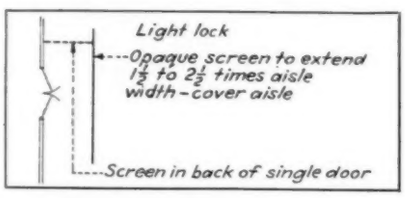
Experiences in windowless plants make good guides to follow in the blacked-out plant. Lighting must be good. The plant must be cheerful. The air must be fresh. Humidity should be controlled. Temperatures should be more carefully regulated. All these help directly in maintaining high morale and are reflected in quantity and quality of output.

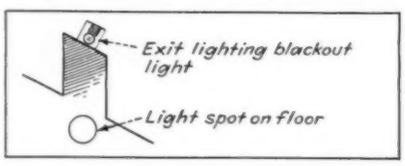
Good lighting for fast, accurate and efficient production becomes a "must" in the permanently blacked-out plant. Lighting systems originally designed to supplement daylight are inadequate for three-shift blackout operation. Frequent cleaning and good maintenance of the lighting fixtures are essential if good lighting is to be sustained. A light colored background improves the effectiveness of the lighting system.

Color on the inside surface of obscuration screen in the plant is beneficial in many ways in addition to improving lighting. Bright, cheerful walls will be reflected in the attitude of the workers, and will compensate for the "uplift" formerly gained when the individual looked from the gloomy interior to the brighter outside. Light reds, orange, yellow or green are likely to have a more stimulating effect than blue. Some variation in color pattern may be more effective than walls of solid color.

The interior side of blackout screens should be light colored and preferably the same color as the surrounding wall.




Blending the screen into its background should remove much of the depressing nervous reaction which fear of possible bombing may give some employees.

### Ventilation

Permanent blackout screens will block much of a building's natural ventilation. Windowless plants, constructed when materials were plentiful, were equipped with adequate exhaust units for the removal of fumes, odors, and gases, and more or less complete air conditioning systems. Since in few other plants such extensive provisions were made, converting them to blackout operation must include consideration of exhaust systems, and some part of an air conditioning system for critical areas in the plant. These systems would consume much scarce material if installed and increase blackout installation costs greatly. None of these units should be installed now unless advantages not connected with blackout furnish the justification for their use.

Open windows, eave louvers, roof openings and open sided buildings frequently have been relied upon to dissipate heat, fumes, odors and gases from areas where production has had these characteristics. After the blackout preparations have reduced natural circulation, some stimulation must be provided to insure safe working conditions. If exhaust fans and units adaptable to this task are on hand, their use may give the necessary increased air movement. If not available, their purchase may be refused due to scarcity of materials. Other methods should be studied.

First know the characteristics and volume of the gases to be exhausted. It may be possible to increase natural ventilation sufficiently by adding more light-locked inlets or outlets. Relocating the inlets and outlets may increase the natural air movement. Location is quite important if directional air-movement is to give quasi-controlled removal of the exhaust gases. Elimination of bends and restrictions in existing ducts may increase the flow of gases and offset blocked natural ventilation. Low points in the ducts should be corrected to avoid blocking the travel of rising gases. *A very small fan inserted in existing ducts may increase velocity enough to avoid installing larger ductwork.*

The position in the plant of the processes emitting heat or fumes may determine or limit the exhaustion methods to be employed. Part of the ventilation study should cover the relation of the process to the production line. If the location is not fixed by the production line, it may be possible to move the operation to a point more easily ventilated.

Depending upon individual process conditions, hoods and ducts to collect exhaust gases may be constructed of other than critical materials. Wood and pressed-board are generally considered to increase the fire hazard but will make satisfactory partitions to enclose dusty areas. Dust removal is simpler from enclosed areas, and the enclosure prevents contamination of the surrounding space.

Leakage around light-locked windows and doors may be insufficient to provide the proper amount of fresh air for the workers. When more inlets are installed, place them away from direct contact with employees. It may be necessary to use ducts to carry fresh air to certain locations, but fans properly located will insure air movement in the rooms often without resorting to ducts. It is almost certain that increased air movement will be needed when natural circulation from open windows and doors

# MAINTENANCE GUIDE SHEET . . . BLACKOUT—BUT KEEP THE PLANT RUNNING

## Similar Procedures for Total and Partial Plant Blackout

**OBSCURATION:**

Screen all exterior openings, including vents, stacks and exhaust units.

Use OCD described obscuration methods, and avoid unnecessary use of critical materials.

**LIGHTING:**

Provide ample lighting for three-shift operation.

Exterior and exposed lighting units must conform to War Department standard units.

**VENTILATION and EXHAUSTION of Gases, etc.**

Increase number of light-locked gas outlets and air inlets.

Check inlet and outlet locations for directional air movement and ventilation.

Locate air inlets and outlets to take advantage of prevailing winds.

Check possible relocation of processes emitting fumes, etc. for venting and exhaust position. Check relation to production line.

Increase velocity of air movement in open rooms with circulating fans.

Use louvers in partition walls to facilitate air movement and release air pockets.

Add fans to increase air velocity in existing duct system.

Improve ventilation in confined areas by ducts to exterior of building.

**AIR CONDITIONS:**

Complete air-conditioning may be permitted in areas where extremely accurate work is done. Avoid unless other advantages prove its worth.

Remove dust and control mositure by water sprays at air intake points.

**COOLING:**

Produce effect of cooling by increased air speed.

Use water-spray in air intake to cool air and remove excess moisture.

Utilize water spray on roof to reduce solar heat.

**HEATING:**

Use positive controls to prevent overheating and waste of fuel.

Increase air movement to secure greater uniformity of heat distribution.

Use water spray to increase humidity in air.

**SABOTAGE:**

Utilize new devices to give alarm if intruders appear during blackout when yard and fence lighting is extinguished.

Utilize new devices to insure against lack of vigilance by plant police and in case of shortage of men for plant police.

**EVACUATION:**

Prepare safe areas for refuge during actual raids.

## Procedures for Portions of Plants Not Blacked Out

**LIGHTING:**

Avoid pulling main switch.

Prepare emergency exits and aisle lighting and direction signs.

Extinguish all exposed lighting except approved emergency blackout installation.

Install control circuit and breakers for immediate blackout of normal lighting.

Install emergency lighting circuit breakers ahead of main lighting breakers.

Use control circuit for quick or automatic lighting of emergency units.

**EVACUATION:**

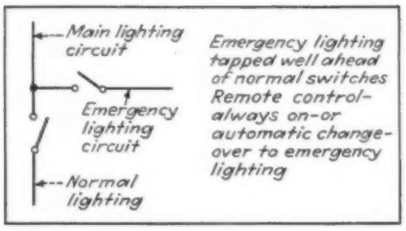
Prepare safe areas for refuge during raids.

Mark exits and aisles and hazards with approved blackout units.

Utilize phosphorescent materials for markers and signs.

Safety of employees to receive first consideration as bombing danger will be present.

**PLAN YOUR BLACKOUT INSTALLATION—DELAY EXECUTION UNTIL ORDERED**


Main lighting circuit
Emergency lighting circuit
Normal lighting
Emergency lighting tapped well ahead of normal switches
Remote control-always on-or automatic change-over to emergency lighting

is removed. A combination of carefully placed fans and openings through partition walls will provide for increased recirculation and make unnecessary a large number of new air intakes.

**Air Conditioning**

Some items in the war program have tolerances so small that limits can be met only in fully air-conditioned quarters. Since air-conditioning equipment can be secured for these purposes, the areas should be constructed as windowless buildings in which blackout will be no problem. It is doubtful whether full air-conditioning of less critical areas will be permitted.

Increased air recirculation in the blacked-out plant is likely to make some control of humidity more desirable. Refrigeration units, if obtainable, would be effective. Passing incoming air through a water spray also will be quite effective. Moisture will be condensed if the water temperature is below that of the air, and moisture will be added to the air if the water temperature is higher than the air.

Introduction of lesser amounts of fresh air will cause a tendency toward overheating. Heating the building will be easier, but controls should be added to prevent overheating. Recirculation of air will also assist in smoothing out temperature variations throughout.

A water spray on the roof will lower temperatures in the areas directly below, providing effective cooling.

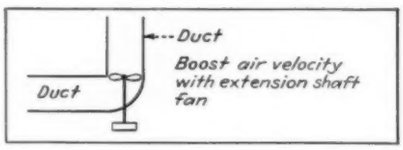
Generally speaking, the danger of any but very infrequent raids applies to the greater part of the country. In those sections, blackouts will be in effect only during actual alerts. All lights not obscured will be extinguished as rapidly as possible. Since production probably will be stopped for not over an hour, this loss will be less serious than using enough critical materials to obscure all lights and so permit operations to continue.

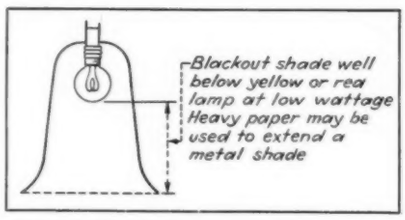
The first warning most plants will receive will be from air-raid signals. Time will be short. Exposed lights must be extinguished promptly. Provision must be made to evacuate employees in safety after the plant is dark.

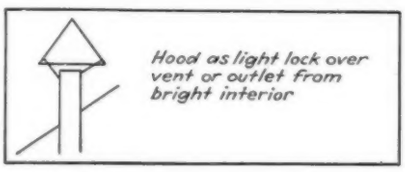
In those portions of the plant not light-obscured, some type of exit, aisle and warning lights must be provided independent of the main lighting system. Guide signs should be illuminated to assist employees in going quickly to designated places of shelter. The lamps used in this safety lighting should conform to the requirements of the Engineer Board, U. S. Army, as previously described.

The location of the blackout lamps must not conflict with the directions of the Engineer Board, but at the same time should reveal obstructions and other hazards clearly enough to warn persons hurrying past. Angles in aisles and all exits should be indicated by lights, but care must be exercised in obeying instructions when lights are mounted near exterior openings.

Phosphorescent materials which will retain luminosity for two to three hours may be used to outline doors, switches,




stairs, elevators, or railings, and for direction signs. Although the glow from these signs will be quite dim, they may prove acceptable in the absence of other lighting. It is recommended that prepared materials be purchased only from reliable producers.

For a quick blackout, even of the entire plant, avoid pulling the main switch. In almost every plant there are certain functions which must carry on and require power. Boiler feed pumps, fire pumps, oil burners, furnaces, exhaust fans handling fumes, cooling fans on process, sewage disposal pumps, and water and oil circulating pumps must continue to function. No lighting is involved in these operations, but stoppage even for the period of a short blackout might delay resumption of production for many hours.

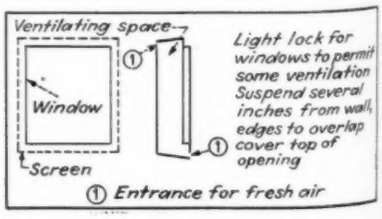
If it is not practical to assign men to lighting panels to extinguish the regular lighting, circuit breakers which may be remotely operated through a control circuit should be installed to replace the fused lighting switches probably now in use. Circuits for the emergency aisle and exit lighting would be connected ahead of these breakers. The emergency lights might operate continuously, have a separate control circuit, or be so controlled as to come on automatically when the regular lighting breakers are tripped.

The wiring and lighting equipment for lighting aisles, stairs and other spaces which must be used during the blackout frequently offers a problem in materials and layout. Some critical materials will be required. The chances of obtaining WPB approval and a preference rating can be materially improved if available circuits and outlets are used as much as possible.

Since it is usually desirable to have all of the special blackout lighting on circuits which are not normally switched, watchman pilot circuits, plug receptacle circuits, signal system circuits, heater and ventilating circuits offer some of the available lines for this service. Since the blackout lighting units are usually small lamps of low wattage these circuits can readily handle the additional load.

Where critical processes must operate continuously, the portions of the plant housing these units should be light-obscured. Such critical areas should include first-aid rooms, toilet-rooms, sprinkler main valve enclosure, main service entrance, essential pump and engine rooms and essential portions of the boiler house. These areas should receive all considerations given fully blacked-out plants in the "Passive Protective Areas."

Fence lighting has been required of most war production plants as protection against sabotage. This will not be operative during blackout. Some protection may be secured during infrequent alerts by diverting some of the interior plant police force to duty along the borders of the property. This will not be possible in areas of repetitive blackout, and other methods should receive study. The electric eye may be employed. Voice control systems have been developed. Charged signal wires may be used. Any device which will sound an alarm upon physical or sound contact should be investigated. As use may release men for production work, its installation may be desirable regardless of blackout conditions.


Ventilating space
Window
Screen
Light lock for windows to permit some ventilation
Suspend several inches from wall, edges to overlap cover top of opening
① Entrance for fresh air

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# Reader's QUIZ

**QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published, we pay $5.00.**

## NOISE IN SYNCHRONOUS MOTOR

*QUESTION 72. We have a 150 hp. synchronous motor in a three bearing frame with an outboard exciter. The motor drives a 25 kw. direct current generator and is used to correct power factor.*

*The motor has developed a noisy rumble. The bearings appear to be in good condition although we have not had a chance to open them up. When it runs as an induction motor there is no appreciable noise. However, when the fields are excited the rumble is very heavy. Voltage and current readings are satisfactory. What is the cause of this trouble? —W.L.C.*

**A.** TO QUESTION 72. Here are two suggestions concerning the observed trouble.

The squirrel cage bars may have worked loose in their slots. They would tend to tighten themselves against the sides of their slots during starting, but would be free to vibrate after the motor had synchronized. An inspection of the point where the squirrel cage bars leave the field poles will show where the varnish is cracked if the bars have been vibrating.

The wear of the bearings may be sufficient to allow the exciter armature to rub the field poles. The exciter air motor and bearing wear would, therefore, have a more pronounced effect at that point. On starting, the exciter armature would run free, but when the exciter flux had built up the attraction at the point of the minimum gap the armature could rub against the field poles and produce the observed rumbling. An inspection of the exciter armature as seen between the field poles will show if there has been any abrasion.—G.I.S.

**A.** TO QUESTION 72. The trouble may be due to the rotor being out of magnetic center with reference to the stator. It may be caused by the motor being out of level, or there may be too much end play in the shaft.—V.M.

**A.** TO QUESTION 72. This noise is caused by one or more of the synchronous motor field coils being partially short circuited. To locate the bad coil or coils, connect the motor field terminals to a d.c. supply of about the normal excitation voltage and then take voltage readings across each individual field coil, being careful to read the meter exactly each time (as there may be only 2 or 3 volts difference). The coil or coils with the low readings will have to be replaced.—L.G.

## STARTING COMPENSATOR

*QUESTION 73. What is the function of a starting compensator in connection with a two-lamp ballast used on a fluorescent lighting fixture? Why is it always connected in the leading ballast circuit?—L.M.*

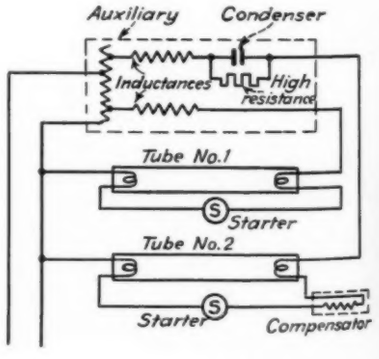
**A.** TO QUESTION 73. A starting compensator is used to preheat the cathode, thus insuring more positive starting under cold and low voltage conditions. It is used on lamps smaller than 65 watt, because the larger lamps have an arc current of sufficient strength to preheat the cathode normally. The compensator, which is a small choke, is connected in the leading circuit because that circuit has capacitive reactance; while the leading circuit has inductive reactance. The compensator, which is used during starting only, produces more inductance in the lead circuit and this in turn, gives a higher filament current and easier starting.—M.L.A.

**A.** TO QUESTION 73. The compensator consists of a small choke coil, and its function is to alter momentarily the constant-current characteristic of the leading branch of a two-lamp circuit so that the current will rise sufficiently to permit proper cathode preheating. This helps insure satisfactory lamp life and lumen maintenance and provides more positive starting conditions at the low temperatures and voltages frequently encountered.—W.W.R.

**A.** TO QUESTION 73. The function of the starting compensator is to aid in properly starting the lamp. Lamp starters are usually designed to operate on inductive circuits. When used in a capacitive circuit the current rises too rapidly, opening the starter circuit before the electrodes have been properly heated.

For this reason a starting compensator, which is an inductive coil, is inserted in the circuit of the leading lamp, so that its normal circuit characteristic will be changed during the starting period. Being connected in series with the starting circuit, the compensator does not function while the lamp is operating normally.—M.F.

**A.** TO QUESTION 73. The function of the starting compensator used in connection with a two-lamp ballast in a fluorescent lighting fixture is twofold. It aids in starting the lamp by giving an inductive kick through tube when the starter opens the shunt circuit through the filaments in series and it limits the current which flows



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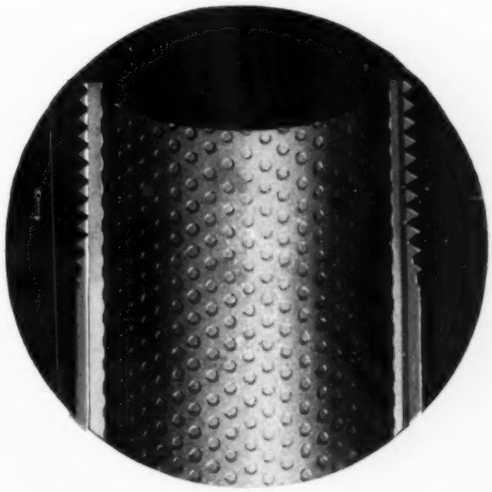

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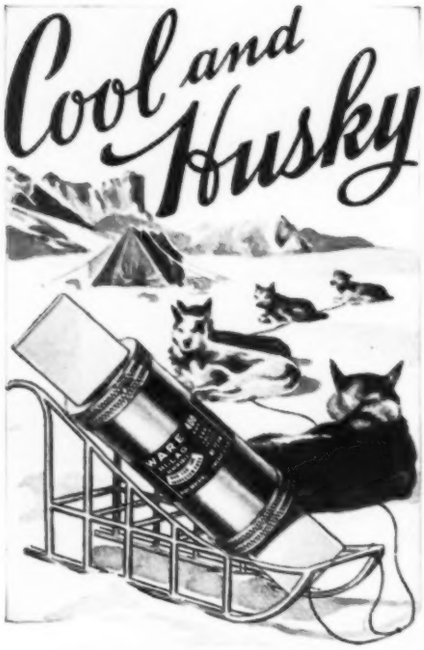
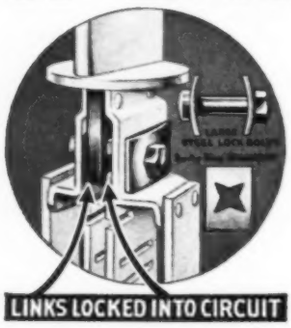



WARE HI-LAG

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WARE Renewable HI-LAG FUSES


## Reader's QUIZ

[FROM PAGE 56]

during the starting period. For the other tube during this period we have the inductance in the ballast and the two tube filaments in series, but in this leading power factor tube circuit we have in addition the condenser. The condenser and inductance are so balanced as to almost neutralize and therefore, the starting current could be very high. Putting in the additional compensator adds inductance and reduces the starting current. See sketch above.—J.E.W.

### INCREASING SPEED OF GENERATOR

*QUESTION 74. We have a motor-generator set with the following nameplate data: induction motor, 440 volts, 50 cycles, 3 phase, 1450 r.p.m. 2 hp. d.c. generator, 230 volts, 1 kw., 1450 r.p.m. compound wound which is operated on 550 volts, 3 phase, 60 cycles; due to the frequency change it operates at 1750 r.p.m. and with 22 volts excess in voltage.*

*The generator is very slow in picking up its voltage, and if allowed to stop for a few days, it will pick up to only 100 volts; then by changing rheostat setting it builds up to over 300 volts and we have to bring it back to its original position for 230 volts. It remains this way until it is stopped again. What can I do to correct this condition?—W.G.*

A. TO QUESTION 74. This is a case of where one thing leads to another. The 20 per cent increase in speed gives an increase in the number of lines of force cut by the generator rotor conductors and gives an increase in voltage. To reduce this voltage you adjust the rheostat to put more resistance in the field circuit and by reducing the amperes in the shunt field, the per cent of ampere flow reduced is considerable. The shunt field when it had 100 per cent ampere as it was designed for was good and strong, very active and stable, but with a 20 per cent or more reduction in current the field is rather weak and unstable. It will operate but needs more regulation and a shot of 100 per cent amperes once in a while. Some machines are more sensitive to a change in field amperes than others. Increasing the air gap will weaken the field and by increasing the field amperes to correct this, it may make the field more stable. The only right way is to have the shunt field coils rewound.—W.L.C.

A. TO QUESTION 74. If the machine has been idle for some time the poles have lost their residual magnetism. Check the voltage drop in the field coils while the machine is running as there might be some shorted turns in one or more of them. If the fields check all right, it might be a good idea to connect a battery to them in series while the machine is idle, being sure to get the right polarity each time. This may build up the residual magnetism, then it will not take the generator as long to build up its normal voltage when it is started.—W.B.

A. TO QUESTION 74. Shunt the field rheostat with normally closed contacts of a 230-volt d.c. continuous duty relay whose coil is connected to the generator terminals. With this arrangement, the generator field rheostat will require only the minor adjustments incident to normal operation.—G.I.S.

### CONTACTORS IMMERSED IN OIL

*QUESTION 75. I have 25 timers operating 25-14 volt coils on 25 ampere contactors. The contactors open and close 125-volt solenoids, the solenoids draw approximately 19 amperes. The 25 ampere double pole contactors operate approximately eight times per minute, 16 hours a day, five days a week. The contact points have to be renewed approximately every 60 days.*

*Do you think the contact points would last longer if they were immersed in oil? Or would you suggest something else that would give me better service?—R.E.P.*

A. TO QUESTION 75. Immersing these contactors in oil would probably aggravate the condition because of the fast continuous cycle of operation. There are a few practical ways of modifying and even eliminating the arcing at the contact point—each method depending upon individual limitations. Injecting compressed air between contacts at a gauge pressure of about 100 lbs. per inch square will help to extinguish the arc and keep the contacts cool. Construction of blow-out coils may also be adequate.

If the power supply is derived from an individual isolated unit—there is one method which may be applied effectively to eliminate arcing. This method involves the use of a shunt switch. The solenoids may be connected permanently to the circuit—and the double-pole switch may be used to shunt the coils instead of opening the circuit. A low IR drop load resistor should be connected to the generator continuously. Absolute improvement may also be obtained by use of electronic control.—O.A.

**A.** TO QUESTION 75. The trouble may be due to the rotor heavy enough to handle the inductive load which is imposed on the contacts due to breaking the lines to a solenoid. Satisfactory operation could be obtained by using a 50 ampere, double pole switch, connecting the two sets of contacts in parallel, and then breaking only one side of the line. This is a procedure which we have used on the small motors on motion picture machines and find it very satisfactory—C.D.F.

**A.** TO QUESTION 75. I do not believe contacts would last longer immersed in oil. Maybe your contactors are single break clapper type—then a double break, vertical action with silver alloy contacts would help a lot. Magnetic blow-out coils or similar equipment would help.—W.L.C.

## LIGHTING A PICKING TABLE

**Q** *UESTION 76. Is there an effective way of lighting a picking table on a coal tipple? This operation is part of the coal chute. As the coal is shaken in passing over, pickers remove the pieces of slate which ride along with the coal. We have tried silver bowl, fluorescent, and HIMV lamps and several types of fixtures, but none seem to satisfy the pickers. Have any readers of this column solved this difficult lighting problem and what equipment and arrangement did they use?—O.B.C.*

**A.** TO QUESTION 76. In this type of lighting problem it is contrast rather than illumination that is required. Install 100–150 watt incandescent lamps without reflectors, spaced about three to four feet apart on the side of the chute opposite to the operators and at the same relative position to the chute as the eyes of the operators. Shield any direct rays from the lamps


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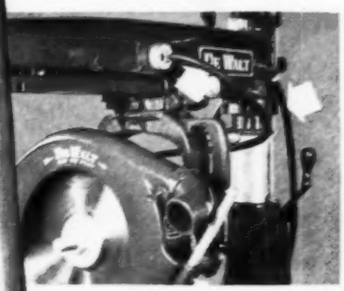

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**FOR TERMINAL INSULATION:** Short lengths of IRV-O-LITE act as insulating sleeves to prevent short circuits between adjacent terminals and metal parts. Ample protection at these places is provided by the high dielectric strength of the tubing. Identifying symbols may be marked on these short lengths, creating a combination wire marker and lug insulator.

**FOR CONDUIT AND EXTERNAL CABLE INSULATION:** Many manufacturers use IRV-O-LITE as both conduit and external cable covering because of its excellent physical characteristics. The tubing is tough, offers high resistance to tearing and abrasion, and provides additional insulation for the wires covered. It resists heat, concentrated acids and alkalies, denatured alcohol, and petroleum solvents, including gasoline.

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|---|---|---|
| Dry Dielectric Strength | 750 VPM | 1000 VPM |
| Wet Dielectric Strength | 350 VPM | 1000 VPM |
| Tensile Strength, lb. per sq. in. | 2150 | 3700 |
| Elongation | 250% | 200% |
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*For additional information on the properties of IRV-O-LITE, sizes available, prices and for samples to be used in testing, write Dept. 96, giving details about application.*

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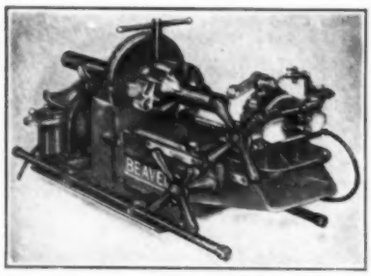

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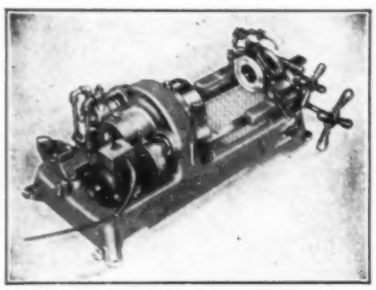

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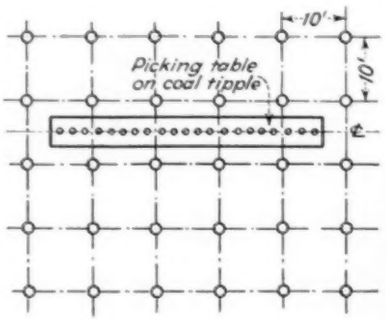
## Reader's QUIZ

[FROM PAGE 61]

to the operators. Unless a subsequent screening and dust-reclaiming operation is affected, a water spray applied to the coal before it passes the pickers may be used to increase the contrast of the lighting.—G.I.S.

A. TO QUESTION 76. The problem requires a level of illumination of over 100 foot-candles of which one fifth should be general illumination. The type of light source is secondary to correct application. Color temperature alters the results little as coal absorbs practically all of the light striking it. Psychologically, most workmen of coal




Legend
O—— Outlet for (1) 200w in glassteel diffuser or (2) 2-40w white Mazda "F" lamps in RLM fluorescent units. Mount 10ft. above floor on spacing shown for general lighting.
o—— Outlet for 150w. clear Mazda "C" lamp in unit equal to Pittsburgh No. 1-201. Mount on 2ft. centers —7ft. above table.

mining class seem to prefer the color of light produced by mazda "C" lamps. Any source of brightness in direct line of vision that measures above 1500 foot lamberts should be eliminated for comfortable seeing conditions.

The accompanying sketch gives one method of obtaining the desired results. However, there are quite a number of other solutions which have, in some cases, certain advantages over this one. —E.B.R.

## STRIPPING TOOL

*QUESTION 77. What kind of tool is used for stripping the steel basket weave covering on cable used for marine wiring?—J.J.L.*

A. TO QUESTION 77. We take a used power hack saw blade cut to 8-in. long and ground on emery

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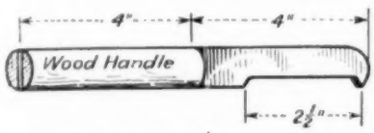
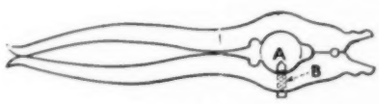
wheel to shape as per sketch. The edge should be left as is from the grinding wheel and not honed to a razor edge as the wire edge will be used to ring cut the cable and pointed end is to cut the




lead sheath and basket weave on larger size cables where basket weave cannot be slipped off after ringing.

Another excellent method is to use a pair of chain pliers. Grind out the hole "a" to size of cable desired to strip; at "b" drill and tap for ¼-20 tap. Take a ¼–20 tap and shorten to about one inch long and then grind end to a vee point




and screw in tapped hole. The tapped hole permits adjustment of the tap and by the position of the vee cutting point you can revolve the pliers to ring the cable; then turn the tap to right angles and pull the pliers down the cable. You can cut the basket weave and also the lead shield without cutting the conductors within.—C.K.

## THREE PHASE POWER CIRCUITS

*QUESTION 78. What are the advantages and disadvantages of three phase power circuits wired as follows? Delta connected primary and Y connected secondary with secondary ground common to secondary electrical center and primary equipment such as transformer cases and arresters. I have several banks of 50 kva. and over wired Y to delta ungrounded now. Grounds have developed in one building and damaged motors in another building where the ground was not indicated by 220 volt lamps wired to ground from each phase.—J.J.G.*

A. TO QUESTION 78. With delta connected primary and Y connected secondary, I presume you are supplying 220–440 power, on account of your Y connection to ground.

Your one advantage is that the breakdown of one transformer would allow you partial operation.

However, if your primary supply could be changed to four wire three phase, you would still have the same assurance of partial power in case of a transformer breakdown.

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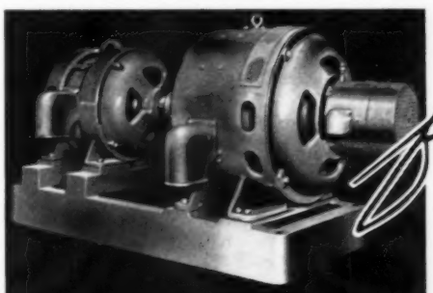

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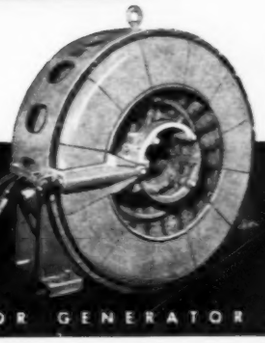

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## Reader's QUIZ

[FROM PAGE 63]

You could have a continuity ground, (tested for low resistance) throughout your plant thus, protecting all of your electrical equipment, in addition, safeguarding life and property.

We all know a blown fuse is much preferred to a damaged motor, so even if you are unable to revamp your primary feed, I would ground everything possible and test frequently for not more than 10 ohms.—W.H.L.

**A.** TO QUESTION 78. Can see no advantage at all in a bank of transformers connected any way but delta to delta. Any other hook-up should be a polyphase transformer, except on a utility system.

On a delta to delta bank you can have one transformer burn out and still carry 57 per cent of full load on the other two transformers by the open delta hook-up.

The advantage or disadvantage as you see it of a "y" connected secondary with neutral ground is that you would have to repair whatever grounded right away as an insulation breakdown would mean a short circuit, blown fuses and a shutdown.

With a four wire "y" hook-up you can tap off single phase very easily. On a delta connected secondary with no ground and line wires A B C, you can have one or more grounds on any one line without a shutdown or any trouble. But with a ground on any one line say line "A" when a ground developed on line B or C things will happen, all grounds would go bad at once—a short circuit.

On any ground indicator only the first ground will indicate, the second usually means a short circuit. As soon as a ground shows up on a delta hook-up, you can run it down and usually repair it before the second one happens or insulate it from the system and repair it when convenient, without a shut down. —W.L.C.

**A.** TO QUESTION 78. The delta-star connection is commonly used for stepping up to high voltage.

*Advantages:* 1. Provides 4-wire secondary distribution. That is, lighting circuits may be taken off between the neutral and any phase wire and power from the three phase mains. 2. The neutral takes the unbalanced current. *Note:* One should remember that the ratio between line voltage in this type system is not the individual transformer ratio, for the line voltage on the sec-

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Fig. 950 Lead Type

Fig. 955 Fiber Type

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WRITE FOR FOLDER No. 300
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ondary side is $\sqrt{3}$ times that given by the transformer ratio. Example, transformer ratio 20:1 primary voltage 2400. Secondary voltage will be 120 volts between neutral to any phase wire, and $\sqrt{3} \times 100$ or 173 per cent between phase wires (208 volts).

*Disadvantages:* 1. If the neutral point of the star secondary is solidly grounded, a ground on one phase will be the equivalent to a short circuit across one pair of the primary lines through an impedance equal to that of one transformer plus the line and ground return impedance up to the point of short circuit multiplied by $1/P^2$.

Apparently your trouble seems to result from numerous partial or high resistance grounds. By a motor being damaged in one building and a ground found in another would indicate that the motor damaged also had a ground. It was probably due to a small leakage current with not enough current flow to indicate on the 220 volt lamps, due to the high resistance of the lamps. The lamp will indicate grounds that have low resistance such as solid grounds or nearly so, but will not show up grounds that have high resistance.

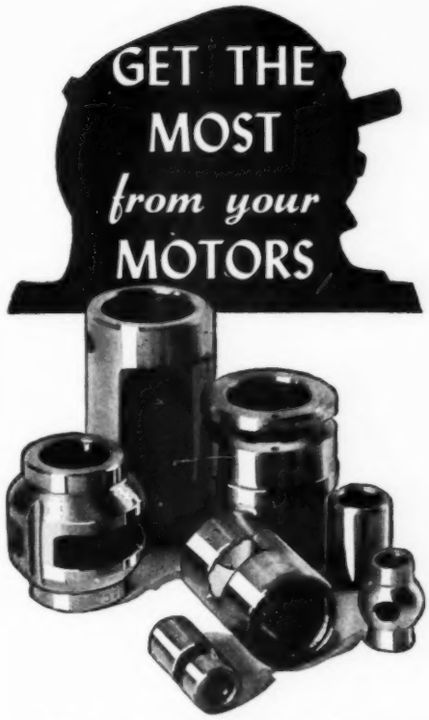
An inspection program where the insulation resistance on each piece of equipment was checked periodically would show up these partial grounds as soon as they start to develop. By use of the Megger a check should be made and a record kept. Whenever the insulation resistance begins to fall below a predetermined value, such as 1 megohm, the cause should be located and removed. Most motor failures will be prevented by this system.

The lights for ground detection are good. They will indicate when a bad ground occurs, and it should be cleared immediately. Such a ground will not cause damage. Its only when the second ground occurs or some piece of equipment has a low insulation that the damage is done.—J.A.H.

## IDENTIFYING LEADS

*QUESTION 79. We have a dual voltage 3-phase induction motor that has its leads burned off in the connection box. As the leads cannot be identified it would involve considerable experimenting to get the correct combinations. Is there a standard system of identifying the leads in the position they come out through the motor frame into the connection box?—R.C.M.*

A. TO QUESTION 79. If yours is a "y" connected motor it has 9 leads. You can identify the three coils that are common on the inside by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*Leaded Bronze*
BEARINGS

In order to get the maximum power from a motor, it is necessary to have it equipped with bearings that *assist* . . . not retard it. The special high-lead bronze in Johnson Bearings enables the motor to operate at full efficiency. Johnson Electric Motor Bearings are available from stock for more than 250 different motors. Try a set on your next overhaul. Check them and see if they don't enable you to get the MOST from your motors.

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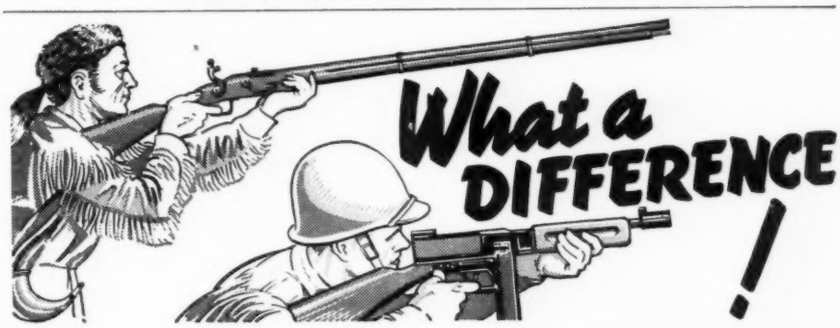
*Sleeve* BEARING HEADQUARTERS
490 S. MILL STREET · NEW CASTLE, PA.




**And there's just as much difference between the *streamlined* BRIEGEL METHOD of making conduit connections and former, old-fashioned methods!**

Take a look at the picture below: two squeezes with the patented B-M "indenter" (which costs only $1.25) and you have a smooth, efficient job when you use B-M connectors and couplings. No extra turns or twists—no nuts to tighten!

The BRIEGEL METHOD saves you up to 50% on time and a substantial materials-saving (in keeping with today's thinking). Means more profit, too! Approved by Underwriters' Laboratory, of course.

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# Did You Know

**that the engineering principles of "Gorilla Grip" Mechanical Connectors call for precisely machined pressure contact with a high electrical efficiency?**

**The illustration above shows how this machined pressure contact actually bites into the copper. The large indentations in the copper conductors are made by the lockring. The smaller ones are caused by the serrated inside surface of the sleeve.**

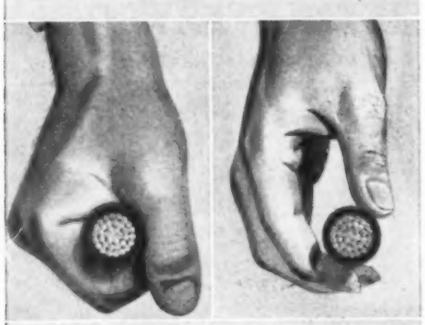

Figure A. Figure B.

**It is common knowledge that you can better hold a round object by gripping it around its complete outside surface (Figure A) and not as shown in (Figure B) compressed between finger and thumb. A complete peripheral grip, as shown in Figure A, is formed by the "Gorilla Grip" Connector.**

**Gorilla Grips compact the conductor in such a manner as to eliminate all loose contact or distorted conductors, thereby eliminating high resistances which in turn cause heat and voltage drop.**

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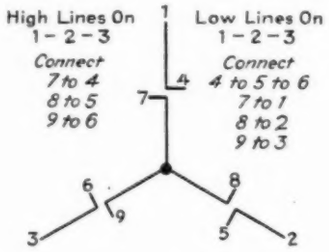
**National Electric**
**PRODUCTS CORPORATION**
1000 FULTON BUILDING, PITTSBURGH, PA.


## Reader's QUIZ

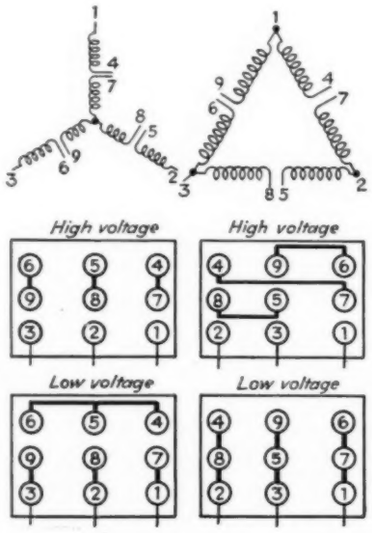
[FROM PAGE 65]

lamp, ringer or other means. Then tag these three leads 7-8-9 respectively. Next pick out the other three coils and keep their ends in pairs. Run your motor on the lower voltage with lines on 7-8-9, next connect one end of a coil




to 7 and measure voltage from the other end to 8 and 9, if the voltages are balanced you have the correct coil to go with 7, i.e. 1–4. Now reverse this coil and check voltages again, it will still be balanced; if the voltage is higher than the first connection, tag the end that is on 7 with 4. The other end will be 1. Do likewise with the other phases and all your numbers will be standard. —E.J.K.

**A.** TO QUESTION 79. Since most motor manufacturers bring out the nine leads of dual voltage motors through a single opening, the individual leads are tagged to correspond with the attached connection diagram. If the leads are improperly tagged or all burned off as stated they may be retagged by measuring the approximate resistance between leads. For example, the resistance between 7 and 8, 8 and 9, or 7 and 9 would be approximately twice that of 1 and 4, 2 and 5 or 3 and

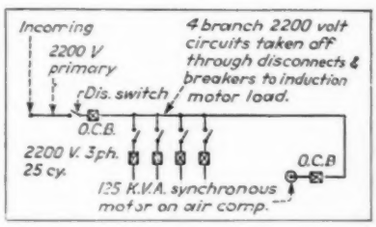



6. Referring to the diagram it is obvious that leads 7, 8 and 9 are the opposite ends of the coils making the star. After leads 1 and 4, 2 and 5, 3 and 6 have been tagged for trial and leads 4 and 7, 5 and 8, 6 and 9 are connected together a check should be made for reversal of windings 1 and 4, 2 and 5, 3 and 6. This will be indicated by noise, low torque, and heating when loaded.

Once the single circuit star connection is made and properly tagged the connection diagram can be used for the two circuit or low voltage connection or vice versa.—B.C.M.

## Can You ANSWER these QUESTIONS?

**QUESTION E3**—Do any of the branch circuits in diagram receive power factor correction from the synchronous motor? If none, how far on the line would correction exist?—W.R.T.


Incoming
2200 V primary
Dis. switch
O.C.B.
2200 V. 3ph. 25 cy.
4 branch 2200 volt circuits taken off through disconnects & breakers to induction motor load.
O.C.B
125 K.V.A. synchronous motor on air comp.

**QUESTION F3**—We are purchasing two 100 kva. transformers for 5500-volt, 2-phase to 240-volt, 3-phase service. We expect later to use these transformers plus an additional similar unit on a 4160-volt, 3-phase, 4-wire service. We have a choice regarding 3-phase primary connections. We can have two high-voltage coils rated 2750-volts with taps at 2400-volts for parallel operation on the 2400/4160-volt grounded neutral system. The other alternative is to have a 5500-volt winding with a tap at 4160-volts for future delta operation. The difference in price is very small. Which is to be generally recommended, the 2400 or the 4160-volt taps?—J.M.T.

**QUESTION G3**—What changes would have to be made to operate a 50 amp., 120 volt d.c. arc spotlight on 120 volt, 60 cycle current?—J.J.L.

**QUESTION H3**—A lead sheathed cable, containing three No. 6 wires has been installed on the ceiling of the basement, and is used to supply power to an ice machine on the first floor. This cable has been installed 12 years. Last week there was a loud report, and upon investigating, the cable had exploded, ripping two sizable holes in lead and insulation, about 6 to 10 inches apart. Can you explain this explosion?—J.M.F.

**PLEASE SEND IN YOUR ANSWERS BY JANUARY 1**

# The Second Vital Move

on the chessboard of global war is beginning—*the offensive!* But this could not have taken place until the first move—the production of the implements of war—was well begun. Management and labor, working together, are delivering tools of war in ever increasing quantities. » » A flood of planes, ships, tanks and other mobile units is pouring from American factories. Okonite is making many of the insulated wires and cables on which they depend for power, control and communication. Even the dearth of rubber has not stopped us, because our research laboratories years ago learned how to use synthetics and other materials for insulation. » » Without the constant faith in our country's future that spurred us and hundreds of other American Industries to maintain these research laboratories—our armed forces might still be waiting for the necessary tools of Victory.

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Last year industry lost 42 million man-days through injuries alone! Think of the staggering cost to the war effort.

Better lighting is one positive way to reduce industrial accident hazards. In one war plant, for example, accidents decreased 11% after a new lighting system was installed. In another the frequency of minor accidents dropped nearly 54% when illumination was increased 18 foot candles.

These figures are from WPB's useful handbook, "Plant Efficiency."

MILLER 50 FOOT CANDLER or 100 FOOT CANDLER will provide an adequate, clear-seeing level of fluorescent *daylight* for busy war plants. Watch what that can do for worker morale and safety programs!

Or it may be some other type of MILLER lighting . . . incandescent or mercury vapor, for instance... is more ideally suited to your customers' needs. MILLER works with all light sources and is in an unbiased position to give you the one best lighting system for each individual project.

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## From Land to Ship Wiring

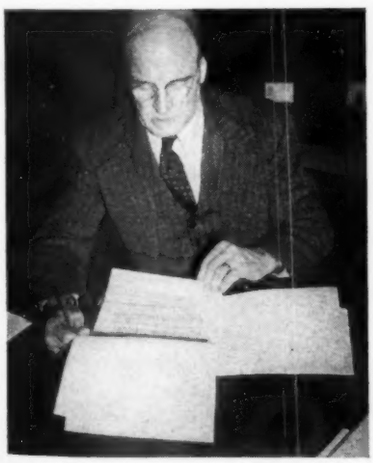
[FROM PAGE 31]

it more beneficial to have the man get an overall picture of the new type of wiring. Then, if occasion demanded, he could be transferred from ship to ship and, if necessary, train more new help as it was acquired.

We consider ourselves rather fortunate in being able to start with five men who had previous shipyard and wiring experience. One unusual stroke of good fortune was that we were able to get a good radio man. At present we have about 80 men in three yards wiring ships ranging from wooden subchasers to large steel patrol boats. We expect tankers to be next in line.

### Transition Easy

The transition from conventional electrical contracting work to ship wiring was not too difficult. The installation methods are different and more exacting, its true, but it is nothing that the average contractor with diligent application and organization can't conquer. We have done it and are still able to maintain the yards and keep our land business going. The first few ships were the hardest, but as we progressed and trained our men, each additional ship was wired in less time and a better job resulted. Furthermore, we get a big thrill out of a good job with A-1 materials and the fact that the wiring we have done will contribute to the safety of our service men at sea.



*JOINT VENTURER H. C. Evans, Evans Electric Construction Co., Inc., Kansas City, Mo., vouches for the workability of contractor combinations, as he checks a daily report from one of his out-of-town jobs. And he should know, for he has been a party to several such enterprises.*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**As good man power becomes scarcer in the present emergency, increase the efficiency of your men by turning to a better use of tools. Let Greenlee Tools help you speed up construction by making the work easier and faster for the man on the job. Greenlee Tools are daily saving contractors from 15 to 75% in time and labor costs.**

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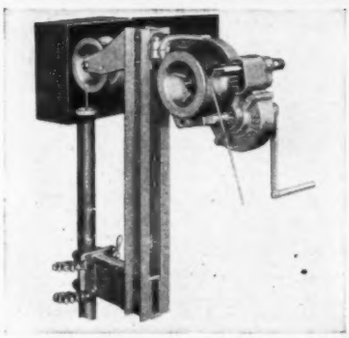
**Whatever you have to bend . . . tubing, conduit, pipe, or bus-bars . . . there is a Greenlee Bender to do the job easier and faster. Small hand benders for copper, brass, and aluminum tubing, and powerful hydraulic benders for 1¼ to 4½-inch conduit and pipe. Benders that are easily operated by one man, save the cost of many manufactured bends and fittings, are compactly built in one unit, and are easily carried to the job and set up. Find out how Greenlee Benders can save you hours on your bending work. . . . write for Bender Booklet S-116.**

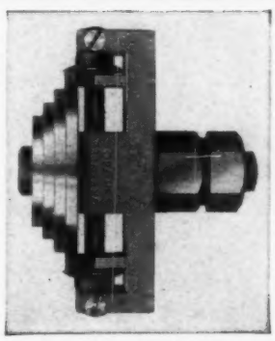
### NO. 765 CABLE PULLER



**Here's a handy tool to make the tough job of cable pulling easy for the electrician. This Greenlee Cable Puller clamps right on to the conduit through which cable is pulled. It has the power to pull from any and all conduit, through long or short runs, through straight or bend conduit, and through open or covered conduit. It is easily carried to the job, can be set up in a jiffy, and is easy for one man to operate with one or two cranks, and will save many hours of work when pulling in cable. For more details send for Cable Puller Folder S-115.**

### GREENLEE KNOCKOUT TOOLS

Greenlee Knockout Punches and Cutters will enlarge holes in metal up to ⅛-inch thick without long tedious drilling and filing. A Knockout Cutter or Punch is inserted in a knockout or a small drilled hole, a few turns of the drive nut with an ordinary wrench, and a hole up to 3½ inches can be cut in 1½ minutes or less. Write for Knockout Tool Folder S-114.



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**TOOLS TO MAKE THE ELECTRICIAN'S JOB EASIER**

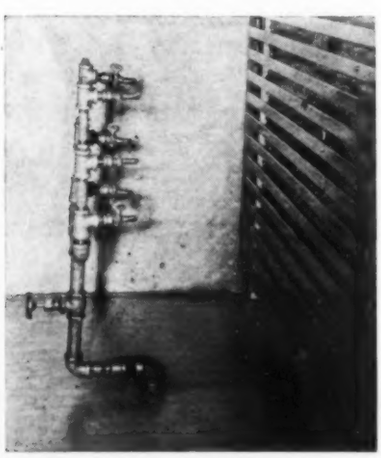
# Motor Shops

## TWIN-BOOTH CLEANING UNIT

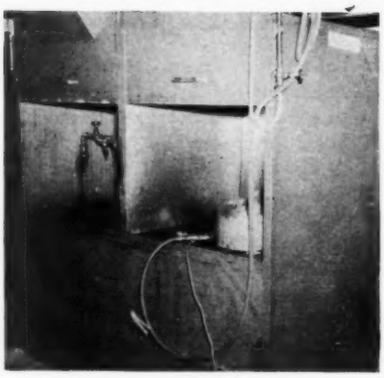
The latest addition to the shop equipment of the Jay Electric Co., motor repair organization of Detroit, Michigan, is a twin-booth cleaning unit which they designed and built for their own use.

The totally enclosed, sheet metal unit is 6-ft. high, 6-ft. wide and 3-ft. deep. Counter weighted, sliding doors enclose each booth. The door for the spray booth has a built-in sight glass for watching the progress of the washing operation.

The pressure spray booth on the left is for washing large parts, stators, and armatures. It is equipped with a light and six nozzles with valves to regulate the spray of cleaning fluid directed on the parts to be cleaned. A motor driven pump circulates the cleaning liquid which collects under the grating of the booth, passes through a filter and returns to the storage tank under the enclosure. Future plans call for a series of spray nozzles to be installed on all sides of the booth and directed toward the center of the grating. Thus any equipment being washed will be thoroughly sprayed from all angles.



***SPRAY NOZZLES** in washing booth are at present in parallel rows. Future plans call for a ring of these nozzles around the perimeter of the booth interior.*



***MOTOR LAUNDRY** with a washing and drying booth facilitates cleaning electric motor parts at this Detroit motor shop. Totally enclosed booths prevent spray splashing and keep this shop area clean.*

Stators are placed in the washing booth, light is turned on, spray is adjusted, motor started and door closed. Periodic peeks through the sight glass will show when the equipment is clean.

After the spray bath is completed, the equipment is transferred to the adjacent booth and dried with a blast of compressed air, from a nozzle and hose attachment. A tubing attached to this air nozzle can be used for spraying small parts with a cleaning fluid.

Sliding horizontal doors at the bottom of the unit, enclose the fluid storage tank and other storage space.

## INSULATION CRIMPER

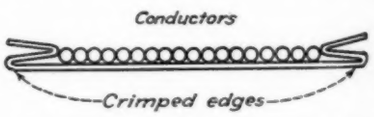
The Electric Service Company, transformer specialists of Cincinnati, Ohio, has solved the problem of keeping the wire of transformer windings from straying over the edges of the insulating fish paper that is placed between the layers of windings on the coils. They have designed a machine that crimps each edge of the insulating paper into a "double-V" which acts as a curb to retain the conductors in place.

The machine consists of two gear driven rollers rotating in opposite direc-

***CRIMPED INSULATION** emerges from this special machine which puts a "double-V" edge on the paper to retain transformer winding conductors in proper place.*

tions; a flat steel feed table and two adjustable guide bars, each equipped, on the inner side, with a crimping blade. Spring controlled lever arms maintain correct pressure on the rollers which pull the paper through the crimping blades and at the same time press the crimped edges.

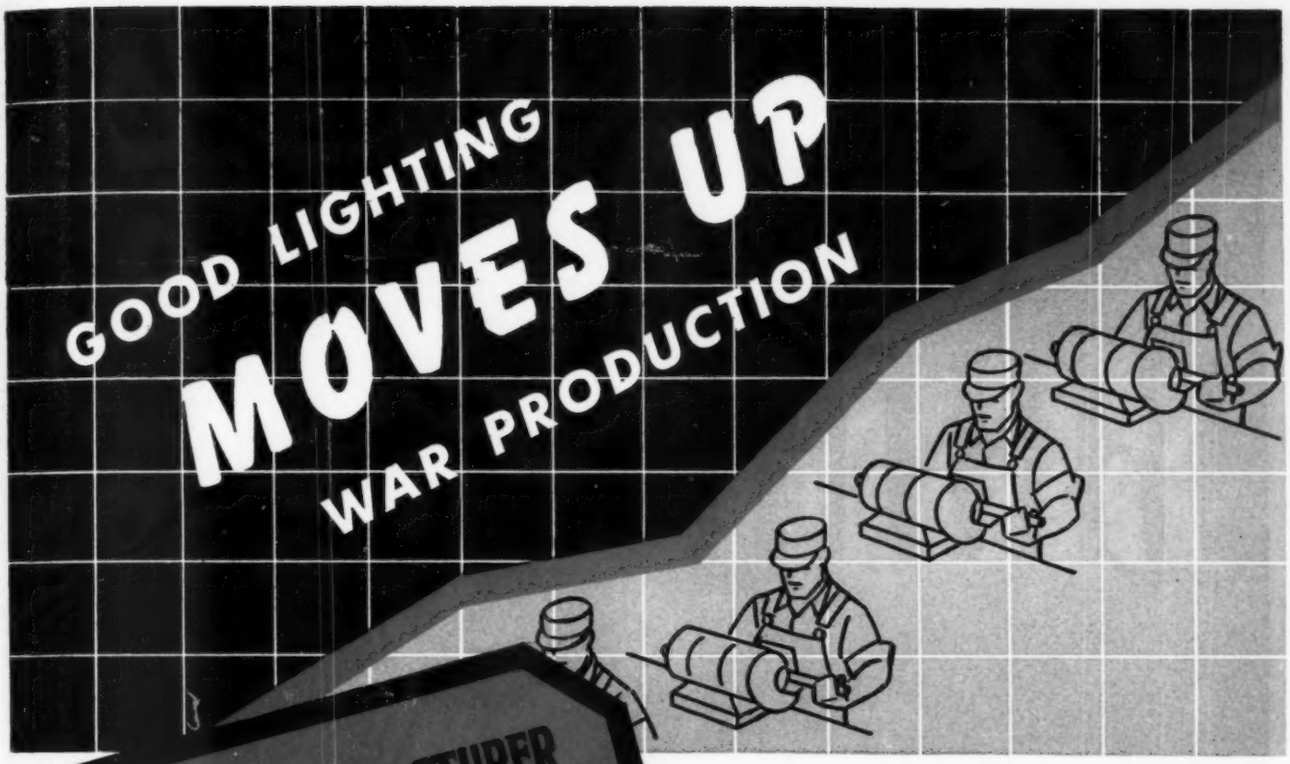
The insulating paper is cut in quantity to the proper width and length, then the entire batch is run through the crimper. The guide bars are adjustable for various widths of paper.




***CROSS SECTION** of insulating paper showing the crimped edges and how they keep conductors in place.*

## BED SPRINGS SUPPORT MICA

When Frank M. Mielke, Mielke Electric Works, Inc., Duluth, Minn., built a special room to keep his insulation materials dry and clean, he fitted a rack for sheet mica. The rack contained seven sections, each 39-in. high, 5-in. wide and of sufficient depth to accommodate the mica sheets. But, unless the bins were chock-full of mica, the sheets would not stand upright as they should. They would lean diagonally across the bin and tend to warp and crack.

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Boston, Massachusetts

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For full particulars write any manufacturer of RLM Industrial Lighting Units, or RLM Standards Institute.

**Guarantee**

This RLM certified lighting unit, when properly installed and under normal conditions of use, is guaranteed against mechanical and electrical defects for a period of 90 days from date of delivery to the purchaser. Correction of such defects by repair or replacement of material only shall constitute fulfillment of all obligations under this guarantee by the undersigned manufacturer or distributor.

*The Letters RLM Stand for Reflector and Lighting Equipment Manufacturers*

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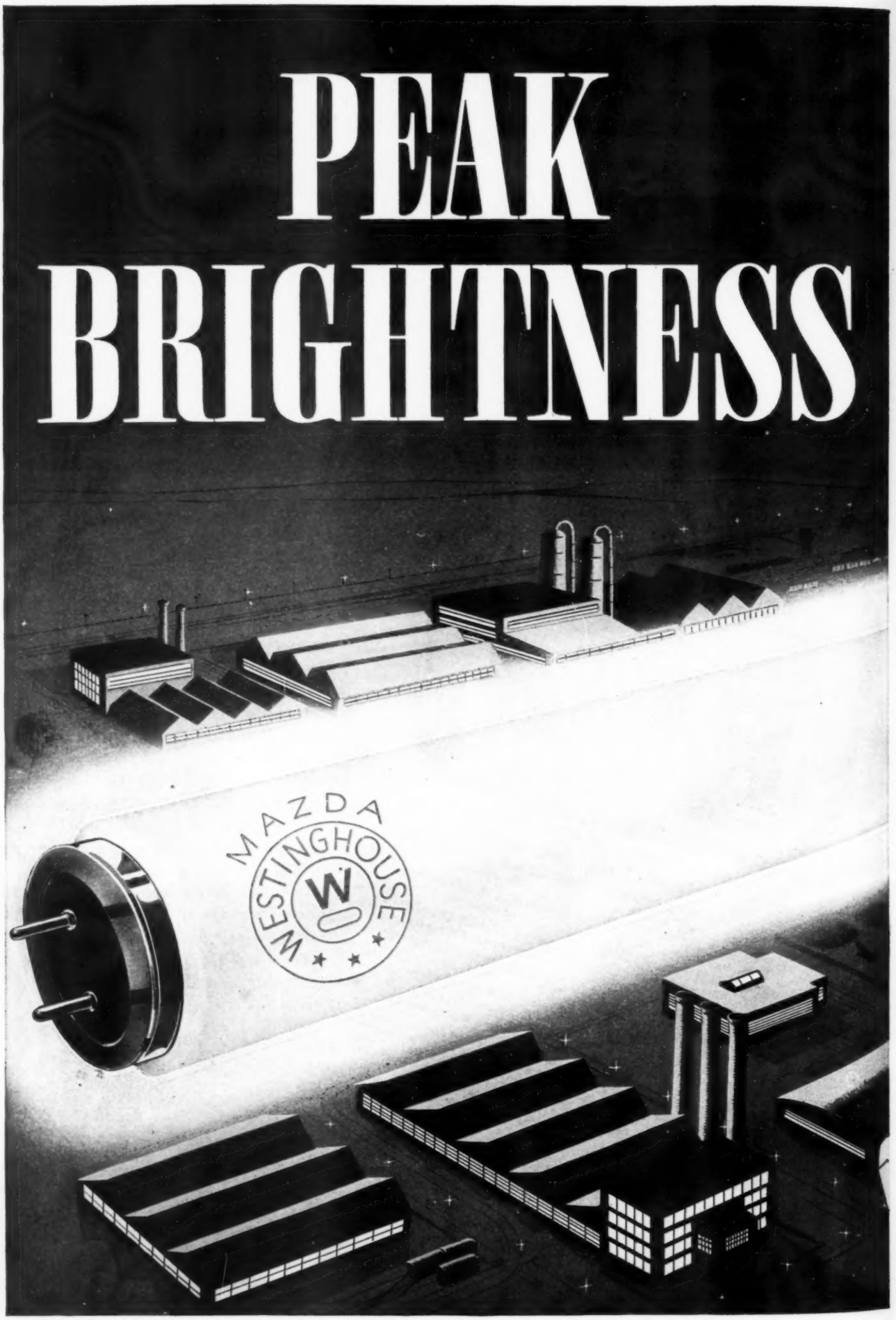
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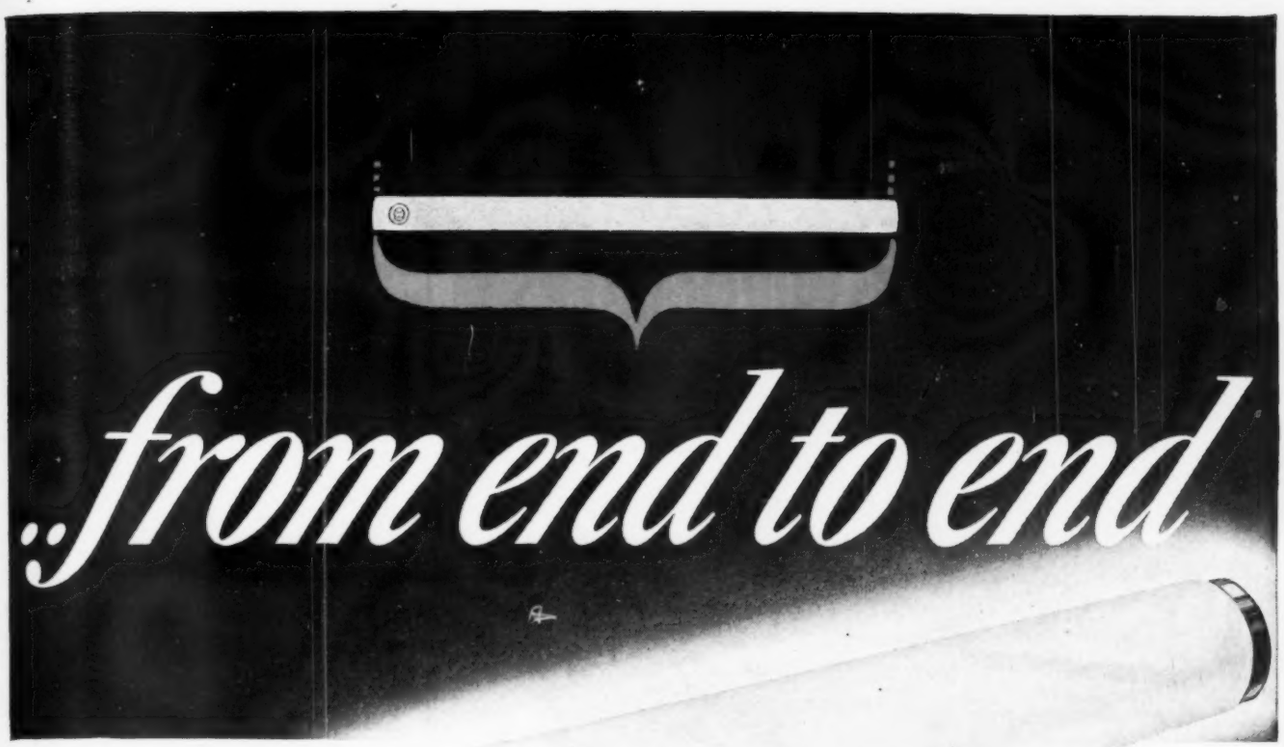
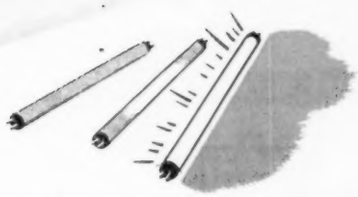
MAZDA
WESTINGHOUSE

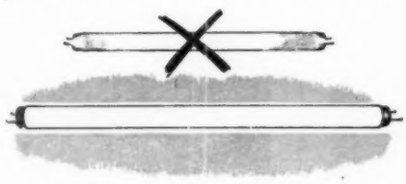



# Westinghouse
## MAZDA LAMPS



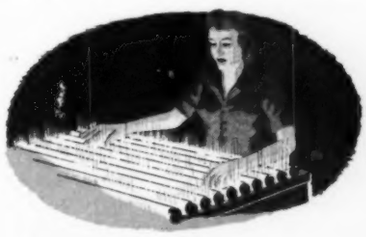
### BRILLIANT PHOSPHORS
***from end to end***

Today's Westinghouse Mazda Fluorescent Lamps produce more light than ever before. This increased brightness is largely due to a new series of lamp manufacturing steps which build up the glow of fluorescent powders to a richer and more sparkling brilliance. It is *this* series of techniques that give Westinghouse Fluorescent Lamps a gleaming brightness from end to end.



### STAY BRIGHT
***from end to end***

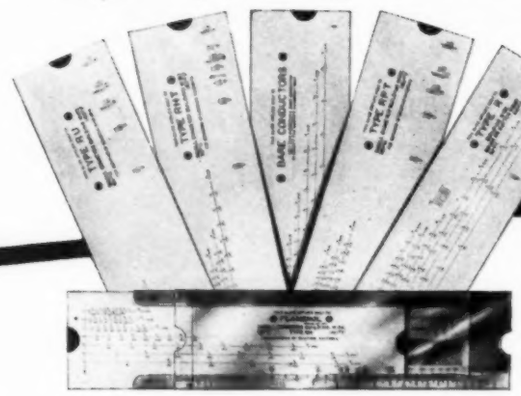
Out of countless hours of laboratory research, causes of early lamp discoloration have been determined and corrected. In Westinghouse Mazda Fluorescent Lamps, a more accurately controlled gas pressure, a more precise measurement of mercury, and a new method of treating cathodes —keep these lamps brighter from end to end.



### SMOOTHLY COATED
***from end to end***

A better and more abundant light also results when the phosphor powder coating inside fluorescent lamps is applied smoothly and to just the right thickness. With microscopic accuracy, a specially-designed machine "paints" a powder film in Westinghouse Mazda Lamps that's *precisely* the right density and texture for maximum illumination.

# FREE
## G-E WIROMETERS
### for Computing Wiring Problems



This Wirometer can be used to determine: (1) conduit fill of all building wires including Type SN; (2) current capacities when more than three wires are run in one conduit; (3) corrections in current-carrying capacity for ambient temperatures over 30 deg. C. (4) voltage drop for eight distribution systems.

**FLAMENOL*** **Building Wire**

This G-E Type SN *small diameter* building wire has synthetic insulation that is superaging, resistant to heat, oils, acids, alkalies and moisture and has high dielectric and mechanical strength.

*REG. U.S. PAT. OFF.

You'll find the G-E Wirometer helpful in selecting the right wire quickly when making rough layouts. It is pocket size — 8 inches long and 2⅜ inches wide. Six interchangeable slides are provided for making calculations on conduit fill of all building wires, current capacities and voltage drop. While this G-E Wirometer is not a cure-all for all wiring problems, it will help save time and simplify design procedure.

**MAIL THE COUPON TODAY FOR A G-E WIROMETER**

General Electric Company
Section W-1221-8
Appliance and Merchandise Dept.
Bridgeport, Conn.

Sirs: Please send me free:

☐ G-E Wirometer
☐ Information on Flamenol Building Wire.

Name.....

Address.....

City.....State.....

GENERAL ELECTRIC


## Motor Shops

[FROM PAGE 70]

Then Frank remembered what kept him from caressing bed slats when he slept. So he dissected an old bed spring and came back with a number of its coil springs. Now they act as flexible spacers in the mica rack, keeping the sheets in an upright position at all times and lessening the danger of warping and cracking. No matter if there are one or 20 sheets of mica in each bin—the springs still do the trick.

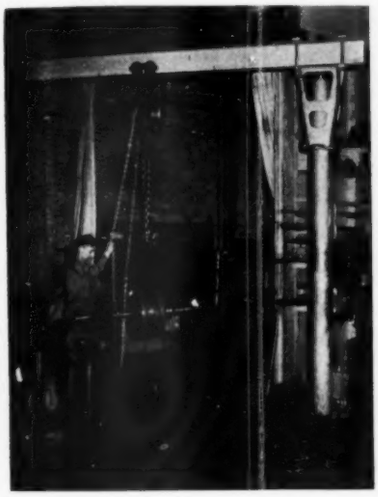
***SPRING SPACERS** keep sheet mica insulation from warping and cracking in its bins. Coil springs from an old bed spring solved the problem.*

***MOTORS FOR DEFENSE,** hundreds of them ranging in size from fractions to 100 hp. and even some as large as 2100 hp., reconditioned and tagged form part of the stock at George Sachsenmeir & Co., Philadelphia, Pa. Power transformers, turbines and generators are also reconditioned here.*

## DUAL PURPOSE SWINGING HOIST

The machine shop of the Excel Electric Service Co., Chicago motor repair shop, is back to back with the loading and unloading drive in the building.

An overhead hoist was necessary to move heavy equipment on and off lathes and to load and unload trucks. So a three-ton swinging arm hoist, mounted



*DOUBLE DUTY hoist on a swinging arm serves loading area and machine shop in this Chicago motor repair shop. Arm extends over intermediate area and aids movement of heavy equipment.*

to a stout pipe column, was installed at the edge of the machine shop partition. The swinging arm extends over the full width of the loading area and also over most of the lathes and machines, serving a double purpose.

A five-ton stationary beam hoist over the drive, aids in loading and unloading exceptionally heavy equipment.

## REPAIR WORK CODED

If and when repaired electric motors are brought to the Mielke Electric Works, Inc., Duluth, Minn., with exaggerated reports of what was done and when—it doesn't take long to get the facts. There is no necessity for shuffling through files, invoices or job records to discover what was done to the motor. Frank Mielke looks over the frame of the motor carefully and suddenly pops up with the information that the motor was rewound and completely overhauled in his shop on such and such a date.

The secret—a coded number stamped on the frame of the motor before it leaves the shop for the customer's address. The Mielke shop have made up their own code of numbers and letters to indicate just what repair work was done on a motor and the date of such repairs.

IDEAL Wire-Nuts

Solderless, Tapeless Wire Connectors

**SAVE CRITICAL MATERIALS!**

Because "Wire-Nuts" do not require lead, tin and rubber—as used in solder-and-tape joints—they are IMMEDIATELY AVAILABLE! They help Speed Your Jobs—and Help Speed Victory; every time you use "Wire-Nuts" you conserve vital materials needed for the war program.

**ONE—TWO—and You're THROUGH!**

"Wire-Nuts" thread onto the wires just like a nut onto a bolt,—Simple, Quick, Easiest Way to make wire joints. Save valuable hours wiring war plants and homes. "Wire-Nuts" pass inspection quickly, FULLY APPROVED. Listed by Underwriters' Laboratories, Inc. Thousands of electrical contractors use "Wire-Nuts" to meet—and *beat*—contract dates.

Strip Wires

Screw On

That's All!

**BETTER, Electrically; STRONGER, Mechanically!**

"Wire-Nuts" powerful grip on wires prevents shorts, grounds and corrosion,—and they withstand several times greater pull than the best soldered joint. SIZES FOR EVERY JOB, for everything from small conduit fittings up to sizes large enough to join 3 No. 10 wires. Write for FREE Samples, today.

PROMPT SHIPMENT

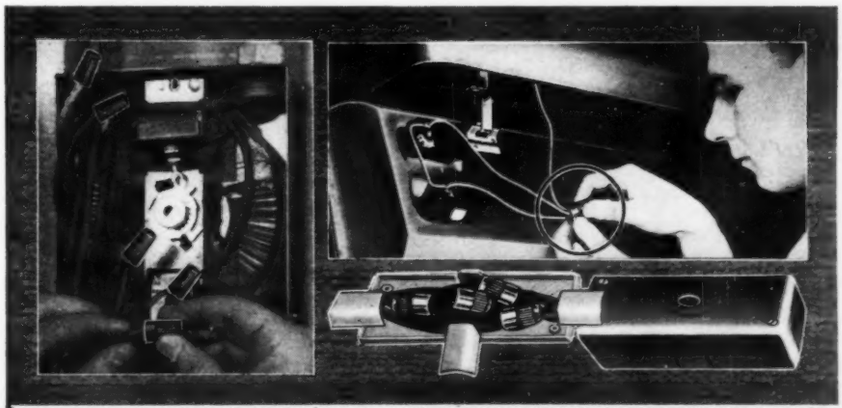
**Other IDEAL War-Time Wiring Speeders**

- Fish Tape Reels and Pullers
- Wire Strippers
- Joist Borers
- BX Armor Cutter
- Cable Ripper
- Switch Box Supports

**SOLD THROUGH JOBBERS**

Unit Heater Installation. "Wire-Nuts" speed up new wiring jobs and simplify changes.

(Upper Illustration) "Wire-Nuts" Speed Up Fluorescent Fixture Installation and Repairs. (Lower Illustration) "Wire-Nuts" occupy very little space. Compact and neat.



**IDEAL COMMUTATOR DRESSER CO.**

1041 PARK AVE., SYCAMORE, ILL. ★ SALES OFFICES IN PRINCIPAL CITIES

# Modern Lighting

## DIRECT GLARE

The improper suspension or inadequate shielding of lighting units can result in bright light sources being directly in the line of vision, causing discomfort to workers and a slowing down

***UNSHIELDED GLARE** from open lamps in the line of vision slows up the workers.*

***REFLECTOR** brings light down to working area and shields workers' eyes and speed production.*

of production. However, the situation can be easily remedied. Usually, it is merely a matter of providing a properly adjusted reflector, or adding a well-designed baffle between the eyes of the workers and the light source.

Electrical contractors can render additional service to their customers by pointing out this and similar lighting faults and recommending their proper solution.

## BLACKOUT LAMPS IN AN INDUSTRIAL PLANT

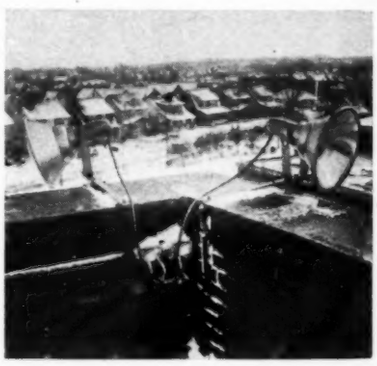
Small 14-watt blackout lamps made to specifications of the War Department are now available on orders bearing preference ratings higher than A-2. These indoor blackout lamps must be used in accordance with the following directions:

1. In any one room, only one lamp is permitted in each 200 sq. ft. of floor area or fraction thereof.
2. Lamps shall be spaced not less than 10 feet apart in any direction.
3. In corridors, one row of lamps is permitted at a spacing of not less than 15 feet.
4. Lamps shall be placed at least three feet from any window, exterior door or other opening.
5. Lamps shall not be pointed toward any window, exterior door or other opening.
6. When openings are covered in the usual manner with drawn window shades, drapes, blinds, or even with one thickness of newspaper, lamps may be installed at any height.
7. When exterior openings are not covered, and when lamps are not otherwise shaded from outside observation above the horizontal, blackout lamps shall be located above the top of such opening.

The accompanying illustration shows a typical installation of these indoor blackout lamps and indicates the general level of illumination provided by such a system. Once the eyes become adapted to this level, passageways, obstructions, etc. are quite visible.

## MOUNTINGS FOR PROTECTIVE LIGHTING

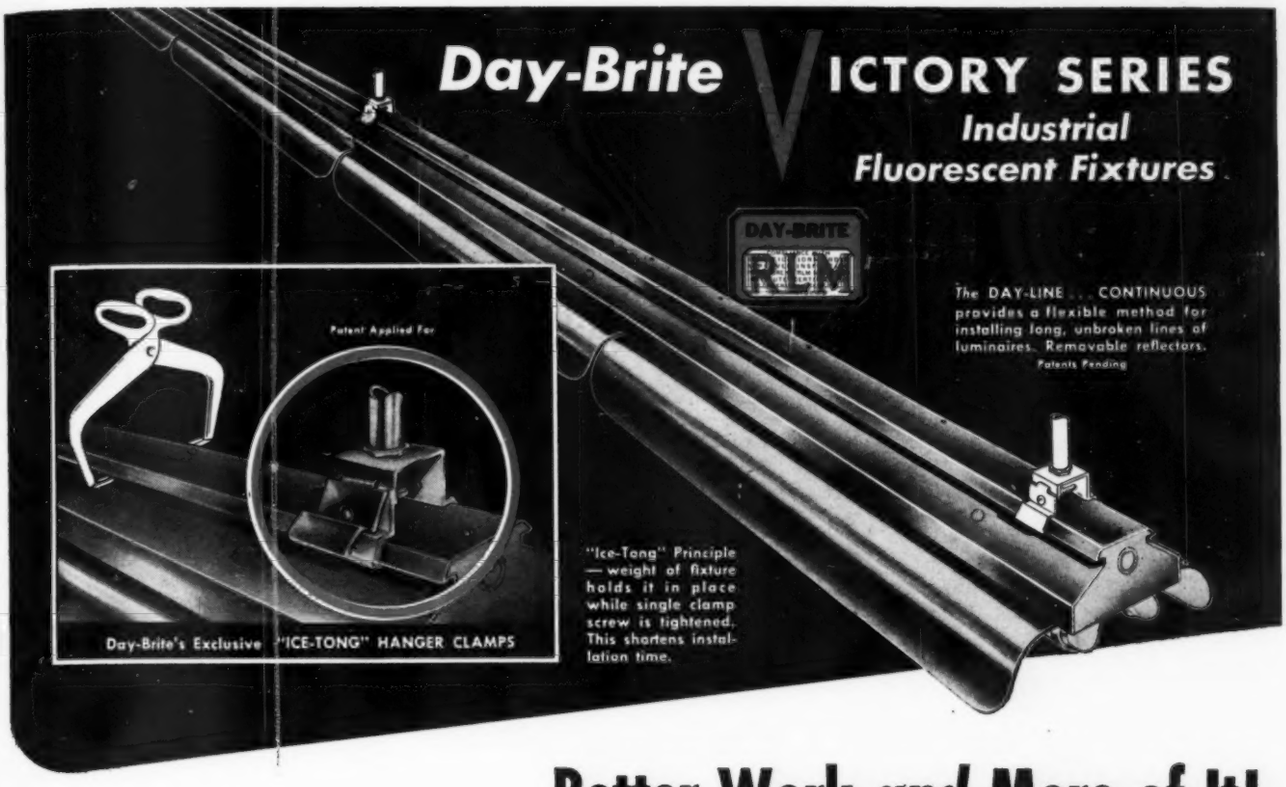
With more and more plants entering the war-production program, the demand for new or more adequate protective lighting has rapidly increased. Obviously, it is desirable to mount such equipment for the maximum satisfactory



***IRON BRACKETS** and flexible cords are used to mount and connect floods.*

***BLACKOUT LAMPS** provide minimum illumination and must be installed to strict specifications of only one lamp to 200 square feet of floor.*

# Day-Brite VICTORY SERIES
## Industrial Fluorescent Fixtures


DAY-BRITE
R&M
The DAY-LINE . . . CONTINUOUS provides a flexible method for installing long, unbroken lines of luminaires. Removable reflectors.
Patents Pending
Patent Applied For
Day-Brite's Exclusive "ICE-TONG" HANGER CLAMPS
"Ice-Tong" Principle — weight of fixture holds it in place while single clamp screw is tightened. This shortens installation time.

# Better Work *and* More of It!

TO SPEED installation time, cut man hours on the job, complete your contracts on schedule and deliver total lighting satisfaction — simply take advantage of these three exclusive features incorporated in the Day-Brite Victory Series Fluorescent Industrial Fixtures:

1. Installation is tremendously simplified with exclusive Day-Brite "Ice-Tong" hanger mounting clamps. You establish hanger mounting centers, not on two lines but on one only—parallel with the length of the fixture.
2. The "super-white" baked enamel finish of the new non-metallic reflectors assures high light reflection values and longer life.
3. Truss-like construction embodied in these fixtures assures maximum rigidity of the completed installation.

In addition, all Day-Brite Fluorescent Fixtures are mechanically designed to provide the greatest ease in servicing, maintenance and re-lamping . . . Call your Day-Brite Engineering Representative.

*The* DAY-LINE UNIT . . . The same construction as the DAY-LINE CONTINUOUS. Can be used as units or in parallel batteries.

**DAY-BRITE LIGHTING, INC.**
5421 Bulwer Ave. - - - - - St. Louis, Mo.

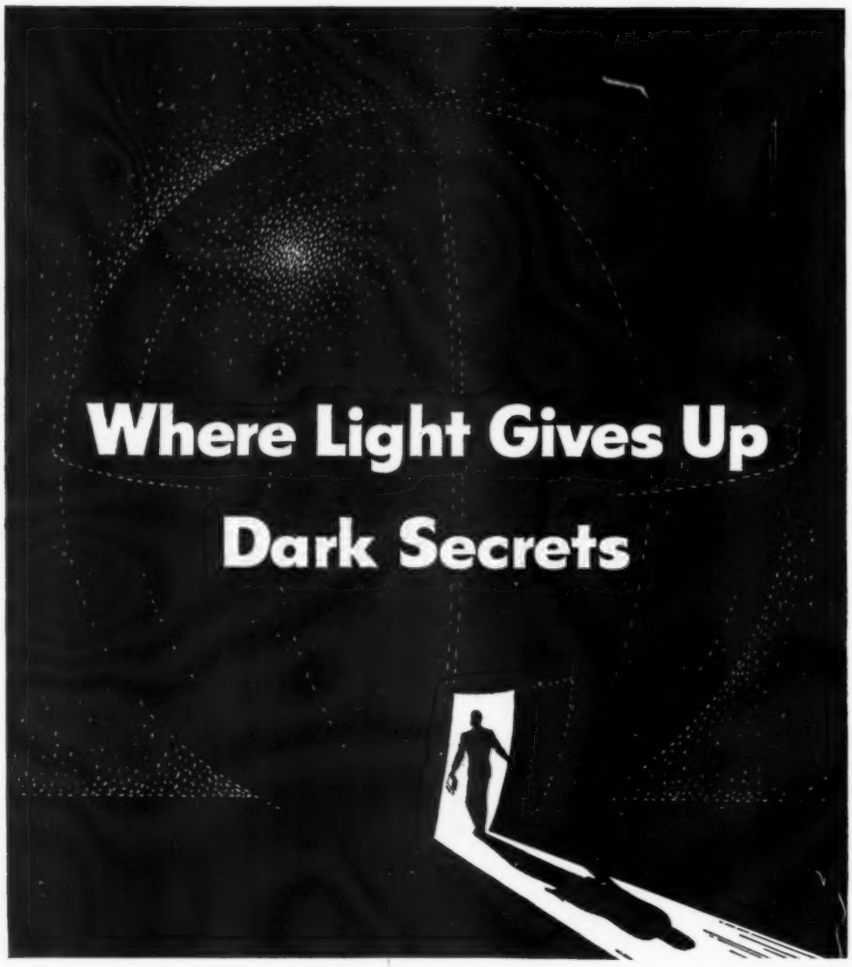
DayBrite Rivals Daylight — Adds Victory Hours!

Patent Nos. 2,281,346, 130,740
Other Patents Applied For

Day Brite FLUORESCENT FIXTURES

59

The COMPLETE LINE OF FLUORESCENT LIGHTING FIXTURES *Nationally distributed through all leading electrical supply houses*




"WHITE as snow" is the inside of this huge spherical photometer. Here, Goodrich research engineers strip light down to its basic elements—with no interference from outside light sources—no interference from reflections inside.

In this modern laboratory, all Goodrich industrial fixtures in the development stage, run the gamut of exhaustive tests—to tabulate their efficiencies, reflective qualities, foot-candle intensities and distribution curves to solve each specific requirement. From it come the many important developments which are providing American workmen with the world's best illumination . . . to eliminate eyestrain and fatigue . . . to promote better workmanship in a better place to work.

Among the hundreds of sizes and styles of Goodrich porcelain enameled industrial fixtures, there is the right one to meet every lighting task.

*Highlite*

*Stocklite*

*No. 90 Floodlight*

*Seprable RLM Dome*

***Protecting vital plants with floodlighting—saving man-hours in production—Goodrich industrial fixtures are serving America's war effort everywhere.***

RLM

LIGHTING FOR INDUSTRY

GOODRICH ELECTRIC COMPANY

OFFICES IN ALL PRINCIPAL CITIES

**GENERAL OFFICES AND FACTORY: 4602 BELLE PLAINE AVENUE, CHICAGO, ILL.**

**SOLD ONLY THROUGH ELECTRICAL WHOLESALERS**


## Modern Lighting

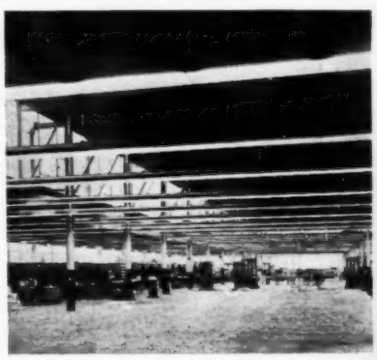
[FROM PAGE 76]

coverage and with a minimum use of critical materials.

In many cases, floodlighting units can be placed atop buildings as illustrated. In this installation, two such units are supported by simple iron brackets attached to the building structure.

### CONTINUOUS ROW LIGHTING

This new industrial area, to be used for war materials and production, will consist essentially of the assembly of delicate apparatus. Within the same area storage of parts and final inspection will also be undertaken. Believing it good practice to install adequate lighting throughout the interior instead of at the location where the product receives final inspection, 50 foot-candles is provided in service throughout the entire area. Continuous row RLM units are employed. The units contain two 40-watt white mazda F lamps and the rows are spaced 10 feet apart.



*CONTINUOUS ROW fluorescent units provide 50 foot-candles in this manufacturing area. Rows are spaced 10 feet apart.*

### BANK LIGHTING

The First Wisconsin Bank, Milwaukee, has recently installed a system of fluorescent lighting as illustrated. Wakefield Grenadiers are placed in continuous rows on Curtistrip wiring channel which also serves as a mechanical support. The units are mounted 8 feet above the floor and equipped with two 40-watt mazda F lamps. This unit also has an open top through which it is

# *Just out!* NEW 16-PAGE BOOKLET!

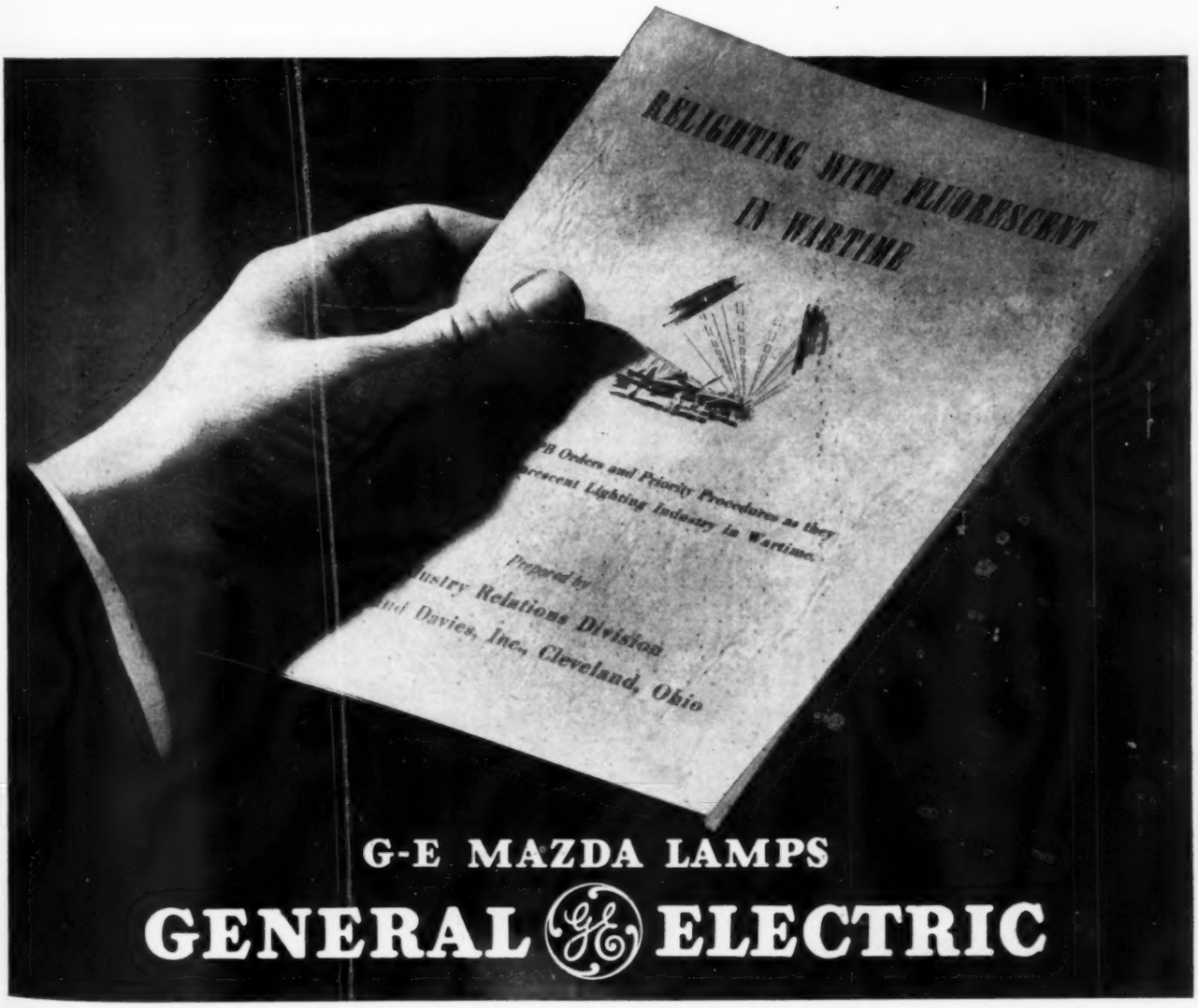
## TELLS HOW TO OBTAIN FLUORESCENT EQUIPMENT FOR ESSENTIAL WARTIME LIGHTING NEEDS!

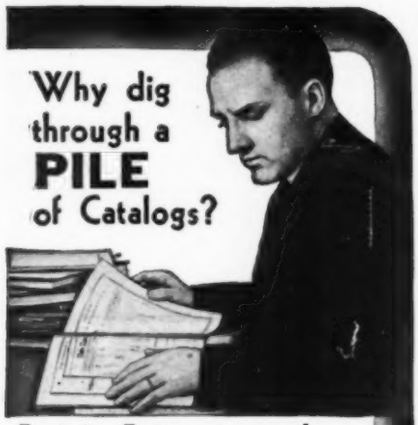
SIMPLY and understandably written, this new 16-page booklet, "Relighting with Fluorescent in Wartime", is a digest of WPB orders and priority procedures as they affect the fluorescent lighting industry in wartime. It is a working manual designed for the use of war industries, wholesalers, distributors, contractors, architects and utilities to help wartime buyers and users of fluorescent lighting obtain essential equipment.

Among the subjects covered are the following: Why relighting jobs aren't handled like new ones . . . WPB's attitude toward lighting . . . How lighting has been restricted . . . Where and how fluorescent lighting fixtures may be sold . . . Filament lighting equipment . . . How to apply for a rating . . . "Do's and Don'ts" for war plants requesting new fluorescent equipment . . . Things to think about before requesting priority ratings on fluorescent fixtures . . . Why we have priorities on lighting fixtures.

*Also contains reproductions of necessary forms required for obtaining priority ratings.*

**Copies of this manual** are available through your G-E Lamp Division office or from General Electric Company, Dept. 166-EC-12, Nela Park, Cleveland, Ohio.






**Find the Fitting you need—quickly—in the COMPLETE line**

If you have a Penn-Union Catalog, you can instantly find practically every good type of conductor fitting. These few can only suggest the variety:

**Universal** Clamps to take a large range of conductor sizes; with 1, 2, 3, 4 or more bolts.

**L-M Elbows**, with compression units giving a dependable grip on both conductors. Also Straight Connectors and Tees with same contact units.

**Bus Bar Clamps** for installation without drilling bus. Single and multiple. Also bus supports — various types.

**Clamp Type Straight Connectors and Reducers, Elbows, Tees, Terminals, Stud Connectors, etc.**

**Jack-Knife** connectors for simple and easy disconnection of motor leads, etc. Spring action — self locking.

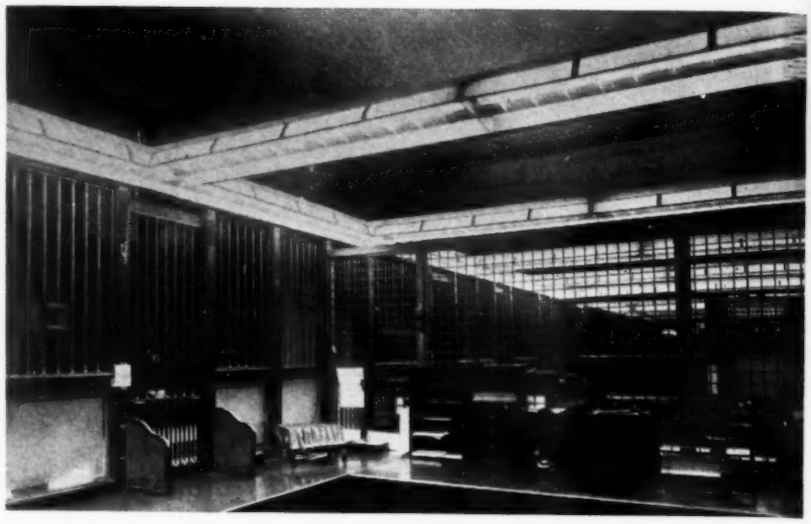
**Vi-Tite Terminals** for quick installation and easy taping. Also sleeve type terminals, screw type, shrink fit, etc. etc.

**Splicing Sleeves**, Figure 8 and Oval, seamless tubing—also split tinned sleeves. High conductivity copper; close dimensions.

**Preferred** by utilities, industrials, electrical manufacturers, contractors — because *they have found that "Penn-Union" on a fitting is their best guarantee of Dependability.*

**PENN-UNION ELECTRIC CORPORATION**
**ERIE, PA.** *Sold by Leading Jobbers*

**PENN-UNION**
Conductor Fittings

*BANK SCREEN lighting from continuous fluorescent units mounted on a wiring channel provide 45 foot-candles at counter level after 100 hours.*

lamped and this allows light to reach the ceiling and thus reduce contrasts between the source and its background. Measurements taken at the end of 100 hours show the foot-candles to be somewhere between 45 and 50.

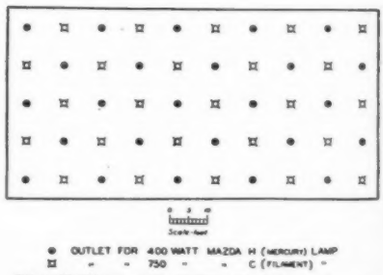
# Lighting A MACHINE TOOL PLANT

**PROBLEM**—To provide high-level illumination for the horizontal boring, drilling, and milling machine erecting floor.

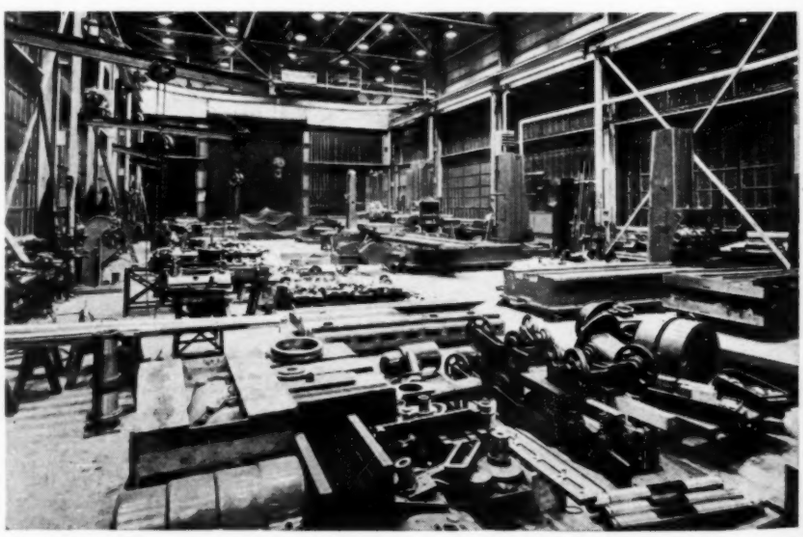
**CONSTRUCTION DATA**—The area is 50 by 100 feet and the ceiling is 36 feet high. Flooring is wood. The crane rail is 24 feet above the floor, and the entire sidewall below the crane-way is glass which eliminates any appreciable sidewall reflection.

**SOLUTION OF PROBLEM**—High-bay Alzak concentrating reflectors are spaced on 10- by 10-foot centers and mounted 30 feet above the floor. The fixtures are alternately equipped with 400-watt Mazda H and 750-watt Mazda C lamps.

**RESULTS**—The average general illumination provided on the working plane is 60 foot-candles in service.




*MACHINE PLANT lighting layout showing the unit spacing and arrangement.*



*HIGH BAY lighting from alternate 400-watt mercury vapor and 750-watt incandescent units provide 60 foot-candles in service.*

# How *KEENER EYES* Can Help to *SUSTAIN* Production*

***In the human eye you'll find the answer to why proper lighting is so important, why it increases the speed and ease of seeing, thus conserving energy which otherwise is wasted in trying to see!***

## SEND FOR THIS FREE GUIDE

*to make certain you are not overlooking important lighting factors essential to a sustained flow of increased output.*

Contains complete data on how to approach, analyze and solve lighting problems. How to analyze the seeing task and determine lighting requirements. Valuable data on lighting as it relates to the problems of increased production, fatigue, accident reduction, greater utilization of floor space, 24 hour operation, etc. Also 21 ready to use solutions of lighting problems most frequently encountered in war production plants. Sent free of cost or obligation. Simply address your request to Benjamin Electric Mfg. Co., Dept. H. Des Plaines, Illinois.

Experience in England and in our own production has proven the importance of doing everything possible to correct those conditions which adversely affect the endurance of men and women to sustain both the quantity and quality of output day after day and month after month.

High on the list of things to do to conserve employee endurance and to minimize fatigue is to insure KEENER EYES for every employee in the plant by providing the proper lighting for every seeing task!

**Relationship of Lighting to Fatigue.** Inadequate or improper lighting has been shown to be an important factor in employee fatigue.* *Because it takes energy to see!** The act of seeing involves thousands of tiny eye muscles, nervous and physical energy.* Time spent in trying to see, therefore, involves physical fatigue.* The greater the effort of the eye to see, the greater the drain on the body's energy reserve. Such fatigue in turn is reflected in reduced production rates and increases in errors, defects and spoilage.

**Save Energy . . . Increase Health and Efficiency of All Employees.** Provide proper lighting and the extra energy formerly required in trying to see can be converted into useful production energy, increasing the worker's ability to stay on the job for longer periods of time without detriment to his well being. Raise the lighting levels and older eyes are raised to the efficiency of young eyes . . . less drain results on their reserve energy . . . the extra light helps compensate for the older employee's loss of visual acuity.*

**Reduce Accidents.** Often closely allied to the fatigue problem is the problem of accidents.* Striking examples of the close relationship between the quality of the lighting and the accident frequency are not difficult to find. For example . . . in one plant, accidents decreased 11 percent after the old lighting system was replaced with a new one.*

**Proper Lighting is Productive Lighting.** Proper lighting is a production tool that is of vital importance in sustaining high output. The amount of light considered proper is determined by the seeing task involved. In general, the greater the difficulty in seeing the object or work, the higher the lighting levels required*. Most industrial and office tasks today require from 35 to 75 footcandles of illumination in comparison with today's estimated average of seven and one half footcandles. Productive lighting, however, is not just plenty of light. Equally important is the quality of the light provided.* It must be suitable in regard to direction, diffusion, glare and shadow.

**Function of Lighting Equipment.** It is the function of Benjamin Lighting Equipment to provide lighting of both proper quantity and quality required by the seeing task. Available for this purpose are Benjamin units of many types utilizing either Fluorescent, Incandescent or Mercury lamps as a light source. Typical solutions utilizing this equipment are given in the "Benjamin Specifications for Productive Lighting in War Plants" described at left.

Request your copy, available now, without cost or obligation. Write Benjamin Electric Mfg. Co., Dept. H, Des Plaines, Illinois.

* *Authority for many of the statements contained in this advertisement are based upon data contained in the publications of the Illuminating Engineering Society, the National Safety Council, the publication "Plant Efficiency" by the War Production Board and* American Recommended Practice of Industrial Lighting *approved by the American Standards Association.*

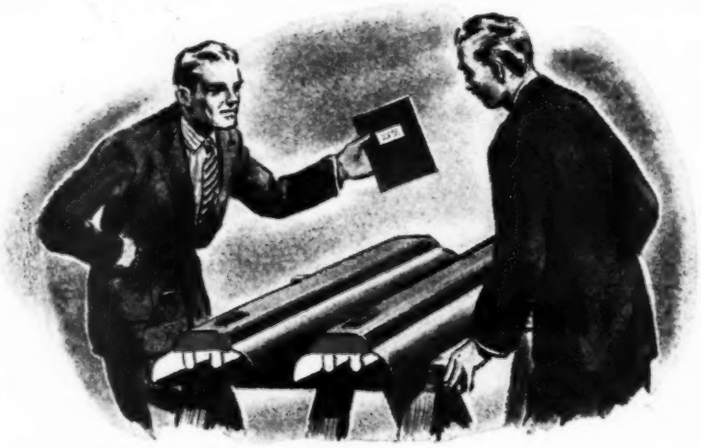
**BENJAMIN** TRADE MARK

**WORLD LEADER IN INDUSTRIAL LIGHTING EQUIPMENT**

*Distributed Exclusively Through Electrical Wholesalers*

*These*
**are the specifications written by experts**

# Learn why they give extra assurance



***Get this booklet now!*** The reasons for the dependability and efficiency of Certified FLEUR-O-LIER fixtures will be pretty obvious to any electrical contractor or wholesaler when he reads the booklet shown above. (A copy will be sent you on request.)

**It gives** the actual specifications—written by lighting experts of the MAZDA Lamp makers—to which FLEUR-O-LIERS are built.

**Read the facts**—and use them. You'll know why FLEUR-O-LIERS are better fitted to help the war plants you serve get the most out of fluorescent lighting.

**Fixtures** wearing the famous FLEUR-O-LIER Certification Label are tested and Certified as meeting the specifications by impartial experts—Electrical Testing Laboratories, Inc. of New York. That means definite assurance of reliable operation and top-notch lighting performance. They are made by over 40 leading fixture manufacturers and all carry the 90-day FLEUR-O-LIER Guarantee on workmanship and materials.

*This* is the label that marks fixtures built to meet them

Certified
FLEUR-O-LIER
The Manufacturer guarantees by affixing this label that this Fluorescent Luminaire is a duplicate of samples found by periodic examination to comply with the minimum requirements as set up in the
"SPECIFICATIONS FOR LUMINAIRES, FITTINGS AND AUXILIARIES FOR FLUORESCENT LAMPS"
which are sponsored by the Manufacturers of Mazda Lamps.
Electrical Testing Laboratories, Inc.
NEW YORK, N. Y.
A COPY OF THIS CERTIFICATE SHOULD APPEAR UPON EACH UNIT OR PACKAGE
E·T·L
E·T·L

## when you plan war plant

# FLUORESCENT LIGHTING!

### NON-FERROUS REFLECTORS

Many FLEUR-O-LIER Manufacturers have already made available Certified FLEUR-O-LIER fixtures using non-ferrous reflectors which meet the requirements of WPB Limitations order L-78 (Amended). They are sold only on an A-1-j priority or better.

*Be sure to send for the comprehensive booklet on the FLEUR-O-LIER specifications. Write FLEUR-O-LIER MANUFACTURERS, 2122-12 Keith Building, Cleveland, Ohio.*

**Here are a few of the rigid Specifications to which Certified Fleur-O-Liers are built**

**MAXIMUM LIGHT OUTPUT** . . . Certified control equipment plus high reflection factor assures efficient light from the lamps.

**BRIGHTNESS** . . . Fixtures must conform to definite shielding standards so that high brightness will not be in the normal line of vision.

**FLICKER CORRECTION** . . . on circuits of two lamps or more. For less eyestrain . . . greater safety.

**CORRECT HEAT DISSIPATION** . . . No danger of overheating in control unit. Assures more light from lamps.

**SAFETY** . . . Fixture must withstand voltage test of 2,000 volts; electrical leakage must not exceed 0.2 milliampere.

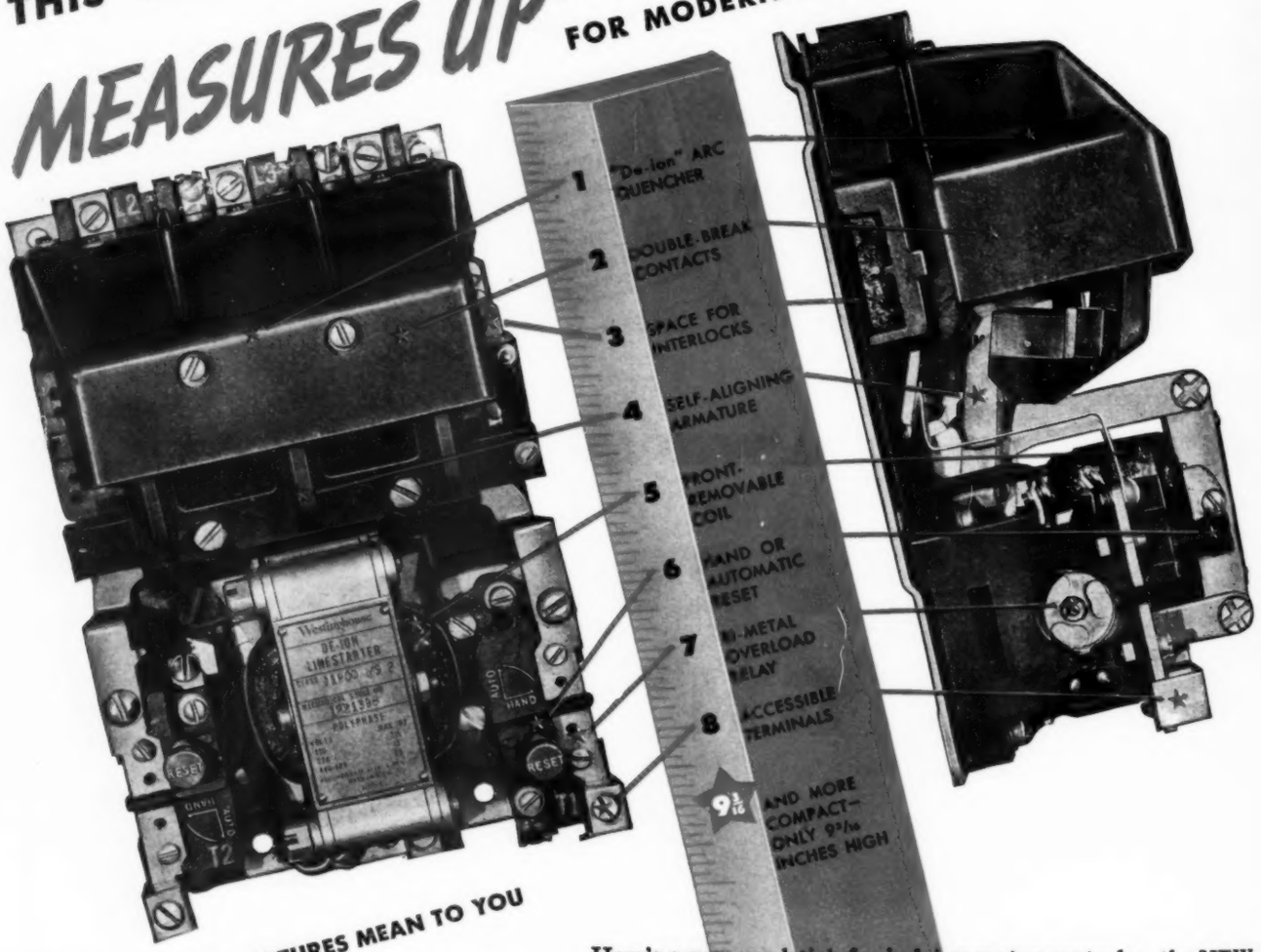
**HIGH POWER FACTOR** . . . The equipment used in the construction of the Fleur-O-Lier unit must provide a power factor of 85% or above (lagging). Means full use of wiring circuit.

# FLEUR-O-LIERS

**CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING**

*Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements*

# THIS NEW SIZE 2 LINESTARTER MEASURES UP TO ALL REQUIREMENTS FOR MODERN MOTOR CONTROL SYSTEMS


1 "De-ion" ARC QUENCHER
2 DOUBLE-BREAK CONTACTS
3 SPACE FOR INTERLOCKS
4 SELF-ALIGNING ARMATURE
5 FRONT-REMOVABLE COIL
6 HAND OR AUTOMATIC RESET
7 BI-METAL OVERLOAD RELAY
8 ACCESSIBLE TERMINALS
9 1/16 AND MORE COMPACT—ONLY 9 3/16 INCHES HIGH

## WHAT THESE NEW FEATURES MEAN TO YOU

1. "De-ion" action quenches the arc, prolongs contact life.
2. Double-break contacts eliminate shunts which fray and break.
3. Interlocks—as many as four—can be easily added.
4. Armature keeps true alignment of contacts, does not "wobble" with age.
5. Operating coil easily changed—front removable.
6. Overload relay may easily be made manual or automatic reset.
7. Bi-metal overload protection assures unchanging accuracy. Size 2 heaters are interchangeable with sizes 0 and 1.
8. Speedy installations . . . "straight-through" wiring.
9. Simplified design for group mountings.

Here's a new yardstick for judging motor controls—the NEW Westinghouse Size 2 Linestarter. It's totally new—redesigned to meet the space and operating requirements of today's machines.

Over-all dimensions are now smaller—making it ideal for group mountings and built-in applications. Yet there's no crowding—all parts and terminals are easily front-accessible.

The overload relay may be made either manual or automatic reset simply by twisting the relay reset button—nothing to remove or adjust.

In addition, this new unit has many other exclusive Westinghouse advantages. There's the safety of "De-ion" arc quenching and the dependable accuracy of Bi-metal overload protection. Write today for Bulletin 3185, giving complete details on the new Westinghouse Size 2 Linestarter. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. J-21253

Westinghouse MOTORS AND CONTROLS

# Questions ON THE Code

Answered by
F. N. M. SQUIRES
Chief Inspector, New York Board of Fire Underwriters

## WIRES FOR UNDERFLOOR

**Q.** *"Rule 3543 states that R.C. double braid or twin wire must be used on open bottom underfloor raceways. Could S.B., V.C. or R.C. single braid be used for other types of underfloor raceway?"—N.V.P.*

**A.** Rubber covered wire is the only kind permitted in underfloor raceways. Where a cement pad is provided double braid rubber covered wire may be used, but without the cement pad the rubber covered wire must be in armored cable or non-metallic sheathed cable.

## A CHICKEN COOP

**Q.** *"In wiring a two decker chicken house with armored cable, is it compulsory to ground the armor? What methods must be used? In wiring a separate brooder house for only one light with about three feet of armored cable exposed, is it necessary to ground such a short length of armor? Current to both buildings is received from overhead outside wires. Where are the above matters referred to in the Code?"—E.A.K.*

**A.** The answer about the grounding of the armor of the armored cables is found in Section 2533 of the Code which states that metal enclosures for conductors (such as armor of armored cable) shall be grounded except in runs or less than 25 feet which are free from probable contact with the ground or grounded metal, etc.

Therefore the armor of the cable in the chicken house must be grounded while the three foot run in the brooder house would not need to be unless it was near to a water pipe or the ground which it probably is not.

The method of grounding is to run a grounding conductor (Section 2556) from the cable armor or from the metal cutout enclosure to either a water pipe or a driven ground. (See Sections 2581-2582).

## LARGE WIRES UNDER TERMINALS

**Q.** *"Is there any rule that governs the largest size wire allowed in a porcelain cutout? On certain jobs I have seen very large wires feeding a bank of 30 amp. cutouts. The lug or strap barely made a contact.—F.R.B.*

**A.** Yes, there is quite a definite rule on this matter. Consider Section 1116 which requires that connections of conductors to terminal parts shall be made by means of splices to flexible leads, by solder lugs or solderless connectors, except that No. 8 or smaller conductors may be connected by means of clamps or screws with terminal plates having upturned lugs. An inspector should therefore turn down a job where wires larger than No. 8 are placed under a terminal screw.

***FIRE PREVENTION** message features wiring hazards uncovered by Inspector Art Welklin of Ft. Wayne, Indiana. The window display was part of a fire prevention program arranged by Fort Wayne Electrical Contractors Association President Arthur C. Stein and Secretary F. H. Ashton in cooperation with Paul Behrens, chairman of the Fire Prevention Commission and Mr. Welklin.*

## SIGNAL WIRES

**Q.** *"I have a job to install wires in conduit to connect some pressure switches which are set into a sprinkler system, to an annunciator in the chief engineer's office to indicate in what section of a building a sprinkler head has opened, thus indicating in what section there may be a fire.*

*There are to be some 17 or 18 of these pressure switches. Am I limited to the use of only nine wires in a single conduit or can I run more than nine wires in a conduit if I use a large enough size?"—D.M.B.*

**A.** These wires are to be used on what is known as a water flow alarm and thus they come under the category of a signal system. The rules governing these systems are found in Chapter 8, Art. 800 of the Code.

The particular point involved here is covered in Paragraph 8006a (1), which states that the number of conductors in a raceway (or conduit) shall be limited only by the requirement that the cross-sectional area of all the conductors shall not exceed 40 percent of the area of the raceway. The number of the various sizes of wires permitted in the different sizes of conduit for the use indicated above, will be found in Table 9, on Page 309 of the Code.

## SALVAGED CONDUCTORS

**Q.** *"Is there anything in the National Electrical Code to govern or guide a person regarding the reuse of insulated conductors which have been in use but which are now to be pulled out of a conduit and may or may not be installed for further use?"—E.W.H.*

**A.** The Code does not directly go into this subject and it certainly would be an extremely difficult matter to give definite rules on, because of the many various factors involved. The matter of what material may again be used must be left to the Inspection Department having jurisdiction; but in these days of war emergencies and shortages of materials, the problem is becoming increasingly difficult, as every bit

FURNISHED ON A
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FOR WAR WIRING
*use* MONCOR
SURFACE WIRING DEVICES

Ideal for Cantonments, War Housing, Field Huts, Temporary Industrial Buildings

Use these good looking devices for surface wiring in war buildings and in war purpose warehouses, industrial buildings, etc. They can be installed quickly using either BraidX or BX. Special knockouts in the ends, sides and back of devices enable them to be end connected, side connected (knob and tube wiring) or back connected for concealed wiring.

These devices meet all requirements on every surface wiring job with cables hidden or exposed. They are made of brown Textolite, keep their color and resist breakage. Moncor Surface Wiring Devices are approved by the Underwriters' Laboratories and in the specifications of different government agencies.

For further information see the nearest G-E Merchandise distributor or mail the coupon.

General Electric Company
Section D1221-8
Appliance and Merchandise Dept.
Bridgeport, Conn.

Sirs: Please send me information on Moncor Surface Wiring Devices.

Name .....

Address .....

City ..... State .....

GENERAL ELECTRIC

Questions on the Code

[FROM PAGE 85]

of usable material must be kept in use although not to the dangerous point of creating possible fires or accidents.

In the case of rubber covered wire, the problems of reuse are manifold. The life of the rubber insulations is affected by heat, humidity, length of use, actions by deleterious fumes or materials, etc. In one case wires in use under favorable conditions for 20 or 30 years may be safe for continuous use or reuse while wire in use under unfavorable conditions for one or two years, may present serious hazards. With rubber covered wire the elasticity of the insulation is about our only guide. If it still has some stretch to it and does not crumble, it should still be good for a limited time in a dry cool location.

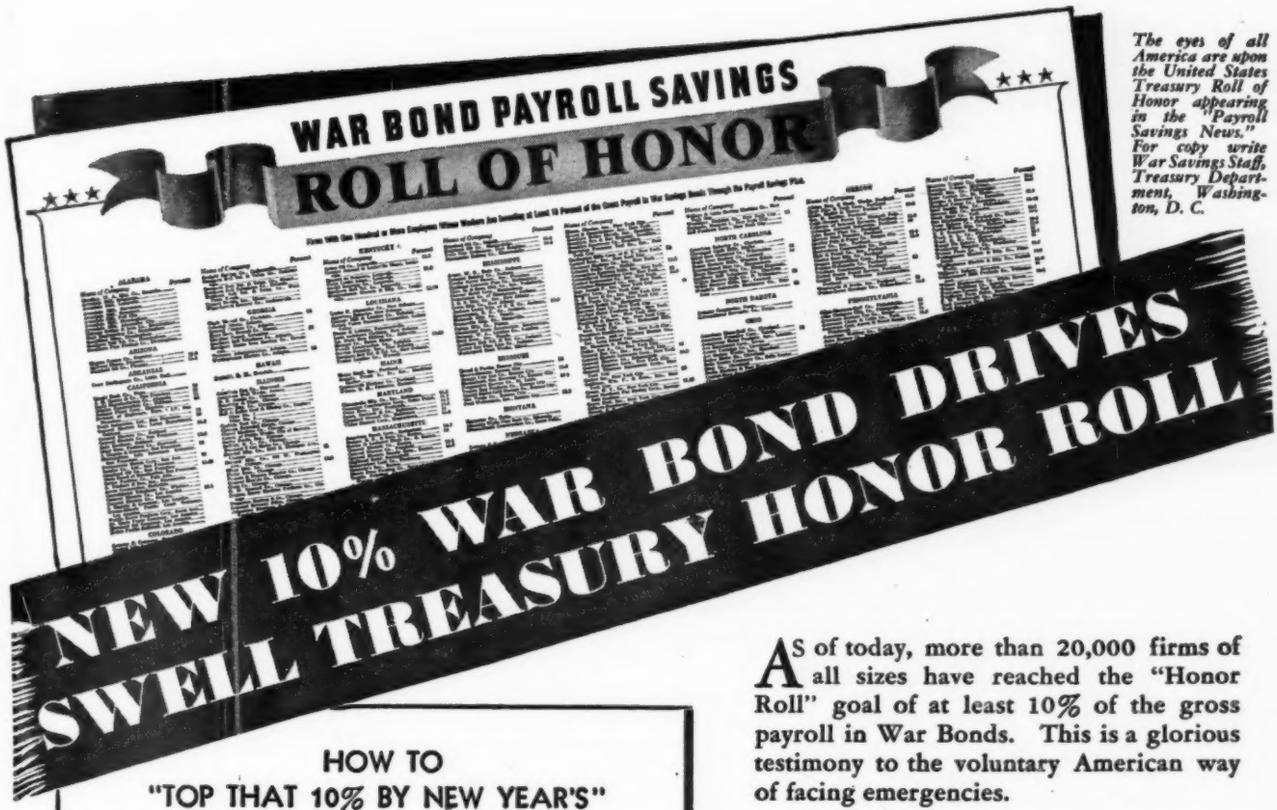
One guide the Code does seem to provide is found in Section 3018—"Insulation Resistance" where certain resistances are suggested. Note that even here they are suggested but not required.

Then too, we must also bear in mind that a rubber covered wire installed in conduit and having an insulation which is dried out to a crumbling point and only held in place by the braided covering, may, in a dry location, give as high an insulation resistance reading as perfectly new wire; but let a little moisture get on this wire and the insulation resistance will probably drop to practically zero, or, try to bend this old wire and the covering will practically fall off. So, in all cases, where there is any doubt as to the quality of the insulation, samples should be submitted to the inspection authorities.

## RACEWAY FILL

**Q.** *"I am installing a metal trough raceway with an interior cross-section of 4 by 4 inches. This is to contain motor branch circuit conductors running from a panel to the motors. How many No. 12 wires can I place in this raceway?"—A.Z.*

**A.** The number of wires permissible in any wireway is limited to 30 by Section 3624 except for signalling circuits or motor control wires. At no time however, can the cross-sectional area of the combined wires (measured over the insulation), exceed 20 percent of the cross-sectional area of the raceway. This latter provision is for the purpose of preventing too great a rise in temperature in the wires.




*The eyes of all America are upon the United States Treasury Roll of Honor appearing in the "Payroll Savings News." For copy write War Savings Staff, Treasury Department, Washington, D. C.*

## HOW TO "TOP THAT 10% BY NEW YEAR'S"

Out of the 13 labor-management conferences sponsored by the National Committee for Payroll Savings and conducted by the Treasury Department throughout the Nation has come this formula for reaching the 10% of gross payroll War Bond objective:

1. ***Decide to get 10%.***
   It has been the Treasury experience wherever management and labor have gotten together and decided the job could be done, the job was done.
2. ***Get a committee of labor and management to work out details for solicitation.***
   a. They, in turn, will appoint captain-leaders or chairmen who will be responsible for actual solicitation of no more than 10 workers.
   b. A card should be prepared for each and every worker with his name on it.
   c. An estimate should be made of the possible amount each worker can set aside so that an "over-all" of 10% is achieved. Some may not be able to set aside 10%, others can save more.
3. ***Set aside a date to start the drive.***
4. ***There should be little or no time between the announcement of the drive and the drive itself.***
   The drive should last not over 1 week.
5. The opening of the drive may be through a talk, a rally, or just a plain announcement in each department.
6. Schedule competition between departments; show progress charts daily.
7. Set as a goal the Treasury flag with a "T."

AS of today, more than 20,000 firms of all sizes have reached the "Honor Roll" goal of at least 10% of the gross payroll in War Bonds. This is a glorious testimony to the voluntary American way of facing emergencies.

But there is still more to be done. By January 1st, 1943, the Treasury hopes to raise participation from the present total of around 20,000,000 employees investing an average of 8% of earnings to over 30,000,000 investing an average of at least 10% of earnings in War Bonds.

You are urged to set your own sights accordingly and to do all in your power to start the new year on the Roll of Honor, to give War Bonds for bonuses, and to purchase up to the limit, both personally and as a company, of Series F and G Bonds. (Remember that the new limitation of purchases of F and G Bonds in any one calendar year has been increased from $50,000 to $100,000.)

*TIME IS SHORT.* Our country is counting on you to—

## "TOP THAT 10% BY NEW YEAR'S"

EVERYBODY EVERY PAYDAY AT LEAST 10%

*Save with*
# War Savings Bonds

This space is a Contribution to America's All-Out War Effort by Electrical Contracting

# Keep Up-to-Date on new developments

## through this FREE SERVICE.....

Electrical Contracting brings you the latest literature of leading manufacturers without cost or obligation.

**STARTING SWITCHES**

**1** A new bulletin describing this line of manual starting switches for motors rated up to 1 hp., 110-220 volt a.c. and ¾ hp., 115-230 volt d.c. It includes dimensions, diagrams and prices. Allen-Bradley Company.

**DISTRIBUTION TRANSFORMER**

**2** Bulletin No. 115 illustrates and describes eight types of distribution transformers. R. E. Uptegraff Manufacturing Co.

**PRECIPITRONS**

**3** Booklet B-3 83, consisting of six pages, features the use of precipitron in war industry production. It describes outstanding applications with illustrations of each. Westinghouse Electric and Manufacturing Co.

**WIRING GUIDE**

**4** Catalog and Wiring Guide No. 16 covers wartime industrial applications of Wiremold products, including the new polarized receptacle and universal type receptacle designed to take plugs with either parallel or tandem blades. Wiremold Company.

**MOTORS**

**5** A set of seven bulletins covering the installation, care and adjustment of motors. Many illustrations are shown. Century Electric Company.

**SOCKET**

**6** A bulletin illustrating and describing a new bakelite weatherproof socket for industrial use. Kulka Electric Mfg. Co.

**LIGHTING FIXTURES**

**7** Bulletin F-62 describes and illustrates V-Series troffer type fixtures with non-metallic parts. Day-Brite Lighting, Inc.

**FANS**

**8** A catalog featuring circulators, exhaust fans, industrial belt-driven fans, high velocity fans, automatic shutter, and attic coolers. Circulars & Devices Manufacturing Corp.

**WIRING DEVICES**

**9** A 24-page catalog illustrating and describing this complete line of non-metallic insulation items and wiring devices. Knox Porcelain Corporation.

**V-BELTS**

**10** A 16-page booklet entitled "Plain Facts on Wartime Care of Rubber V-Belts." It applies to all makes of V-belts. Allis-Chalmers Mfg. Co.

**SIGNALS**

**11** Catalog No. 42 features sections on bells, buzzers; horns, sirens, air trumpets; pushbuttons, relays, transformers and a "Guide to Good Signaling," which contains charts, graphs and tables. Schwarze Electric Co.

**CONTROLS**

**12** A new bulletin describing this line of Bulletin 836 pressure and temperature controls and showing suggested methods of application. Allen-Bradley Co.

**GENERATOR SETS**

**13** A new booklet illustrating and describing high cycle motor generator sets for high speed tools. Burke Electric Company.

**MOTORS**

**14** Bulletin B6052-C gives facts for quickly choosing correct motors for wartime applications. Charts, construction features, dimension ratings and price lists are included. Allis-Chalmers Mfg. Co.

**CABLE**

**15** New data sheet illustrating and describing bus drop cable. It gives construction features, table of diameters and weights. General Cable Corp.

**MOTOR MANUAL**

**16** Bulletin GED-1017, consisting of 40 pages, is a Motor Fitness Manual and discusses how to get the most service out of old and new motors, "switching" motors from one job to another and equipping old machines with

[Continued on page 90]

**Circle numbers, sign and paste on your letterhead and mail in an envelope.**

**ELECTRICAL CONTRACTING** **December**
**330 West 42d St.**
**New York, N. Y.** **(Not good after February 1)**

**Please send me without obligation, manufacturers' literature herein described and identified by numbers circled below.**

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**31 32 33 34 35 36**

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COMPANY .....

ADDRESS .....

CITY ..... STATE .....

# Westinghouse

## RLM NONMETALLIC REFLECTORS

*provide*

**MORE LIGHT**
**EASY MAINTENANCE**

For the want of steel—new nonmetallic fluorescent reflectors have been developed which give more light for 'round-the-clock war production and provide easy maintenance. They're the new Westinghouse pressed reflector-board reflectors—for 40-watt and 100-watt luminaires and for continuous-strip installations.

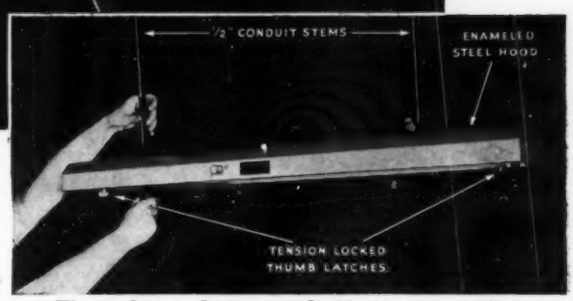
These easily detachable reflectors are interchangeable with previously installed equipment. There's neither wasted time nor effort in installation or servicing. Their durable, high-reflectivity finish resists scratching and chipping and is repellent to industrial acids and fumes.

Nonmetallic reflectors are further examples of Westinghouse engineered seeing—the ability to adapt lighting to present-day war needs. For complete information, just write Westinghouse Electric & Manufacturing Company, Edgewater Park, Cleveland, Ohio, and ask for Folder B-3190.

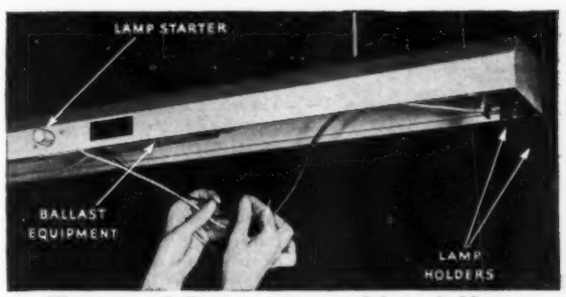
117 Westinghouse Electric Supply Company Offices and Independent Westinghouse Lighting Distributors provide local stocks and services.

# Westinghouse

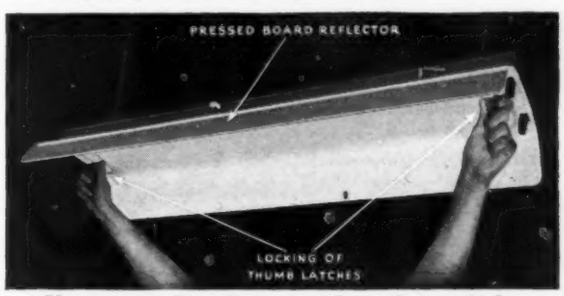
**LIGHTING EQUIPMENT**




Westinghouse fluorescent luminaires are easily installed. Units are arranged for rigid conduit, flexible conduit, or chain mounting.




Fluorescent ballasts, starters, and lamp holders are mounted in the hood. Units are furnished completely wired and ready to install.

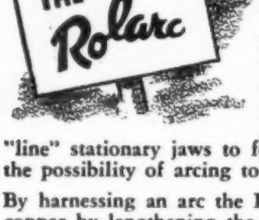



New nonmetallic reflectors can be easily attached or detached. Units are approved by the RLM Standards Institute, and are so labeled.

Federal

HARNESSED AN ARC

TO KEEP WAR PRODUCTION ROLLING




There's an aggressive spirit swinging through the country's war working plants—a grim determination to win in the shortest possible time. But to win the war we must first win the battle of production.

That's where this new 575 volt Rolarc Safety Switch comes in. Available from 100 to and including 600 Ampere capacity, it is designed on a radically new and advanced principle of arc control. Two parallel rollers snap together immediately upon disengagement of the blade from the "line" stationary jaws to form an insulated barrier that interrupts the arc—reducing the possibility of arcing to an *absolute minimum.*

By harnessing an arc the Federal Rolarc offers many advantages—conserves war-vital copper by lengthening the life of the switch . . . increases the safety factor . . . saves priceless time and power by eliminating dangerous arcing . . . increases production by eliminating delays caused by switch failure.

These are but a few of the reasons why more and more progressive electrical wholesalers and contractors are switching to the Federal 575 volt Rolarc Safety Switch to "keep 'em rolling."

*Get complete information about this amazing Rolarc—write for bulletin 42-12.*

*Until stocks on hand are exhausted we must reserve the right to ship our regular 575 Volt Switch unless Rolarc is specified on the order.*

FEDERAL ELECTRIC PRODUCTS COMPANY, INC.

48 PARIS STREET, NEWARK, N. J.

PANELBOARDS • SWITCHBOARDS • SAFETY SWITCHES • CIRCUIT BREAKERS

## New Literature

[FROM PAGE 88]

new motors. Also selection and application of motors. General Electric Co.

### PANELBOARDS

**17** Bulletin No. 67 illustrates and describes this line of panelboards including standardized, lighting and appliance, branch circuit types, circuit breaker, fuse only and switch and fuse. Frank Adam Electric Co.

### INSTRUMENTS

**18** Bulletin No. 715 describing and illustrating model DS chronometric tachometer or speed indicator. Herman H. Sticht Company, Inc.

### CIRCUIT BREAKER

**19** Catalog 3350 features 15,000 oil circuit breakers for indoor service, classes 150-TCR-3 and 250-TCR-3. Roller-Smith Company.

### BALANCING MACHINES

**20** Booklet describing Dy-Namic balancing machines for balancing armatures, fans, wheels, gears. It also contains data on balancing and its importance in eliminating noise and premature wear. Bear Mfg. Co.

### LOADING

**21** A new 20-page booklet, B-3103, describes Cop-R-Temp loading, a method of transformer loading which saves critical materials by eliminating "overtransforming." Westinghouse Electric & Mfg. Co.

### STARTERS

**22** A new bulletin describing the complete line of Bulletin 640 semi-automatic resistance starters for manually starting polyphase squirrel cage motors. Allen-Bradley Company.

### V-BELT DRIVES

**23** Bulletin B6051-C discusses the problem of selecting correct V-belt drives for wartime applications. It gives charts and tables, stock sizes, dimensions and construction details for all Texrope Drives. Allis-Chalmers Mfg. Co.

### LIGHTING AND INFRA-RED

**24** A 20-page booklet illustrating and describing how good lighting and near infra-red process are speeding production of war materials used on the land, on the sea and in the air. Fostoria Pressed Steel Corp.

### RECTIFIERS

**25** Bulletin R-40 covers general information on selenium rectifiers, including their assembly, plate sizes, efficiency, input voltage, stability, cooling, regulation, etc. Benwood Linze Co.

**ARC-WELDING ACCESSORIES**

**26** Bulletin GEA-2704B, consisting of 32 pages, illustrates and describes a complete line of arc-welding accessories. General Electric Co.

**FLUORESCENT REFLECTOR**

**27** A four-page bulletin illustrating and describing this new non-metallic industrial fluorescent reflector "Dur-O-Lite—plus—Insta-Lite." Spero Electric Corp.

**SAFETY SWITCHES**

**28** Bulletin No. 42-10 shows the features and advantages of the new weatherproof, dust-tight heavy duty safety switches. Also contains a complete listing of specifications plus list prices. Federal Electric Products Co.

**SWITCHGEAR**

**29** Catalog No. 1110 illustrates and describes horizontal drawout metal clad switchgear in 100,000, 150,000 and 250,000 kva. capacities at 5000 and 15,000 volts. Roller-Smith Company.

**LAMP BALLAST**

**30** Booklet GES-3033 is entitled "For remarkable savings in lighting war plants, the new G-E Forlamp ballast." General Electric Company.

**LIGHTING MAINTENANCE MANUAL**

**31** Booklet No. M-42, consisting of 24 pages, is a pocket-size manual telling "How to make the Most of your Electric Lamps and Lighting". It is illustrated with practical sketches. Champion Lamp Works.

**ELECTRICAL PRODUCTS**

**32** A quick reference listing of all Colt electrical products covering safety switches, service equipment, multibreakers, industrial controls, circuit breakers, service boxes, fuses and accessories. Colt's Patent Fire Arms Mfg. Co.

**LIGHTING FIXTURES**

**33** Data Sheet No. 512 covering the "Day-Line" continuous fixtures with four-lamp ballasts for 220 volt operation, with non-metallic reflectors for 100-watt lamps. Day-Brite Lighting Inc.

**REDUCTION DRIVES**

**34** Catalog R-42 gives information on reduction drives. With a standard speed ratio of 13 to 1, they deliver any desired driven speed from 11 to 154 rpm. American Pulley Co.

**ELECTRIC HEAT**

**35** A booklet, GES-2922.1 featuring stories on electric heat in industry. General Electric Co.

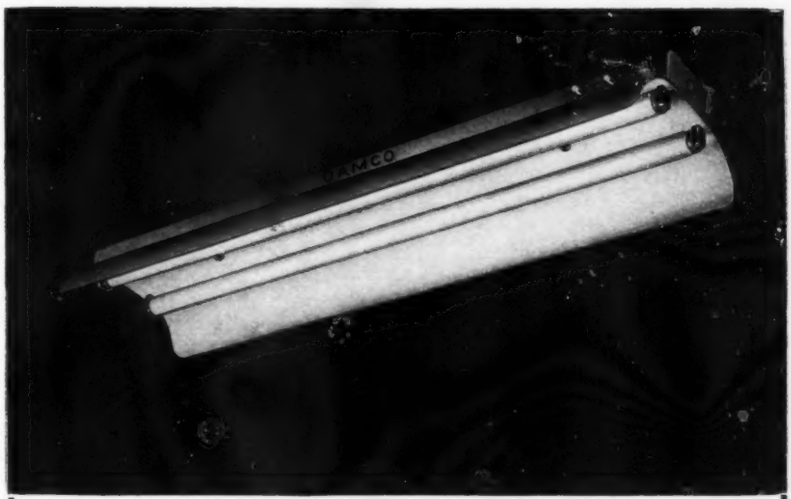
**GRINDING WHEELS**

**36** A new Mounted Wheel Manual, consisting of 64 pages of data on grinding wheels for every industrial applications. Chicago Wheel and Mfg. Co.


# NEW OAMCO

## Non-Metallic

## FLUORESCENT FIXTURES FOR BETTER LIGHTING IN WAR PLANTS




*. . . simplified design*
*. . . saves critical metal*

**RLM Reflectors**

Get a copy of the OAMCO Incandescent Catalog which describes and illustrates this and a wide variety of reflectors for every purpose. Listed therein is equipment to meet every requirement for industrial, commercial, and institutional lighting—indoor and out.

★ The new OAMCO Industrial Fixture is made of a rigid non-metallic material and treated with two coats of glossy white, chip-proof enamel that gives it a reflection factor of 85%. These fixtures are baked at 300° F.—have a tough hard surface that will not discolor—are easy to clean—and conform to the requirements of the National Bureau of Standards. Adaptable to 110-125, 220-250 volt industrial installations, in Double 40, Triple 40, and Double 100 units. May be mounted either by Jack Chain, Direct to Conduit, or continuous row. Write today for complete facts on this new addition to the OAMCO War Production Line!

**RIGHT LIGHT SINCE 1902**

**OVERBAGH & AYRES MFG. CO.**

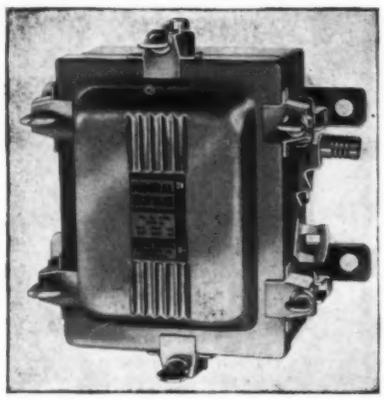
*MEMBER OF THE R L M STANDARDS INSTITUTE*

411 SOUTH CLINTON STREET • CHICAGO

# EQUIPMENT News

## Safety Switch

This new weatherproof, dust-tight, heavy duty safety switch is available from 30 to and including 1,200 ampere capacity. It is recommended for use in hazardous locations, where efficient operation of regular switches is hampered by excessive dust or lint, or where weather and climate might interfere. Employing a heavy rubber gasket plus a cover-within-cover, switch assures waterproof protection. Federal Electric Products Company, 50 Paris Street, Newark, N. J.



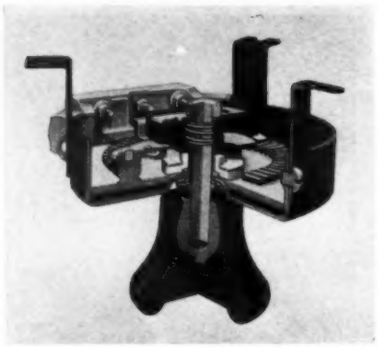
FEDERAL SAFETY SWITCH

■

## Wire Terminal

A small wire terminal, known as Hylug, has been developed for standard, aircraft and navy cable. Three sizes take from No. 22 through No. 10 Str. Many variations are available—with a sighthole for inspection; with a closed back for moisture proof sealing; with or without an insulation shroud; and in different tongue shapes and dimensions. For insulating sleeves for Hylugs, Versiflex tubing is recommended. Burndy Engineering Co., Inc., 459 East 133d Street, New York, N. Y.

BURNDY WIRE TERMINAL



WARD LEONARD RHEOSTAT

## Rheostat

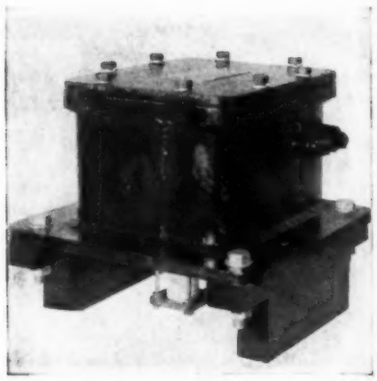
Bulletin 69 pressed steel rheostats meet the need for a small, sturdy, power rheostat having a large number of steps and ample current carrying capacity. They are four inches in diameter with 43 steps of control and are rated for 100 watts. Spacings through air and creepage distances between parts of opposite polarity and between current carrying and grounded parts meet the requirements of AIEE, NEMA and Underwriters' Laboratories for 300 volt service. Other features are balanced contact arm, "dead" shaft construction, copper graphite contact shoes and front or back-of-board mounting in single and multiple assemblies. Ward Leonard Electric Co., Mt. Vernon, N. Y.

■

JEFFERSON LAMP BALLAST

## Lamp Ballast

Two new multiple lamp fluorescent ballasts have been developed. No. 234-983 is for operating three 40-watt lamps and No. 234-982 is for four 100-watt lamps. These multiple lamp ballasts reduce the amount of critical materials required, save installation time and reduce power consumption. The new four-lamp ballast is designed for operation on line voltages ranging from 250-280-volts and is applicable to circuits in the 265/460-volt Y class. Jefferson Electric Company, Bellwood, Ill.



WESTINGHOUSE HCL DETECTOR

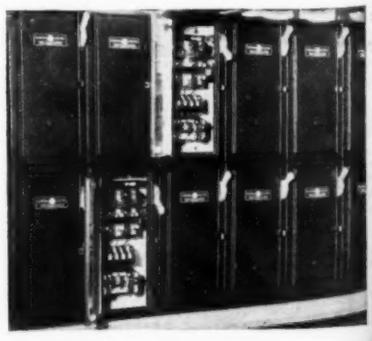
## Detector

The HCL detector for Inerteen transformers, is a new method of protection which minimizes damage to transformer windings. It may be used to give warning of very small arcs by detecting the presence of HCL gas formed by the decomposition of liquid. Because detector operates almost as soon as arc occurs, it reduces possibility of high pressures forming within the tank. It can be used to operate an alarm or circuit breaker, disconnecting the transformer from the feeder. It can be installed on new or existing transformers. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

■

## Magnetic Starters

A new line of a.c. combination magnetic starters for full-voltage starting of induction motors up to 7½ hp. has been announced. Available only in NEMA sizes 0 and 1, starters consist of fusible motor-circuit switch and magnetic starter in one unit. Operating handle is projected through front rather than side of case. Motor-circuit switch has silver-surfaced, snap action contacts of roller type which break stalled motor current. Vystipe fuse clips hold fuses in place. Forms are also available with thermal circuit breakers in place of fusible motor-circuit switch. Bimetallic overload relays are adjustable for either hand or automatic reset and protect motor from overheating. All terminals are clamptype, front-connected. General Electric Co., Schenectady, N. Y.



COMBINATION MAGNETIC STARTER

"THE MINIMUM TYPE OF WIRING WITHOUT METAL BOXES, TUBING, OR CONDUIT SHALL BE USED"
SAYS THE ARMY AND NAVY MUNITIONS BOARD

# MODERN Porcelain PROTECTED WIRING SYSTEMS ANSWER THAT!

**The Army and Navy Munitions Board, in its latest "Prohibited Items for Construction Work" gives a list of prohibited items the use of which will not be permitted except under special circumstances. Unlike most metals, PORCELAIN is not prohibited—is immediately available—and is an important factor in today's efforts to conserve vital materials.**

★ Important indeed was the availability of Electric Porcelain materials when restrictions were invoked on the use of steel, zinc, copper, rubber, and other materials vital to the war effort. Porcelain was not only ready for the emergency, but was proved as safe, adequate, durable, easy to install, and highly economical. Porcelain has been used in wiring, both commercial and residential, for the past fifty years.

Porcelain Protected Wiring Systems installed now will be serving long after peace is won. Consider this durability as you plan today's wiring jobs—Porcelain outlasts the building.

You not only conserve critical materials by installing these modern Porcelain Protected Wiring Systems now but you conserve too for your customers by giving them safety, adequacy, durability—with resultant cost savings.

You can meet all of your immediate wiring jobs with Porcelain Protected Wiring Systems—in installation, in layout, and in design you have every advantage.

## MODERN PORCELAIN PROTECTED WIRING SYSTEMS

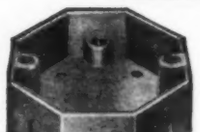
★ ILLINOIS ELECTRIC PORCELAIN CO.
*Macomb, Ill.*

★ KNOX PORCELAIN CORPORATION
*Knoxville, Tennessee*

★ PORCELAIN PRODUCTS, INCORPORATED
*Findlay, Ohio*

# Save with ILLINOIS All Porcelain WIRING SYSTEMS....

★ USE LESS VITAL MATERIALS
★ DO JOBS IN LESS TIME
★ CUT MAINTENANCE

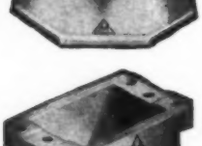


OUTLET BOXES

Glazed and unglazed styles conforming to all existing standards of dimensions, spacing, position of knock-out holes, and mounting screws. High mechanical and electrical efficiency.

SWITCH BOXES

Insure greater safety in wiring and the elimination of all grounding hazards. Made of best quality white porcelain. Metal inserts are placed in two holes of the switch boxes for receiving screws of standard switches, plugs, outlets, etc. Knockouts for single wires, also for cables. Specify and use them.



STANDARD TUBES

In sizes ½ to 48 inches, 5/16 to 3-inch diameter in following types: unglazed, glazed, split, floor, split floor, headless, curved end, cross-over split, and cross-over. Diameters all uniform both inside and outside.

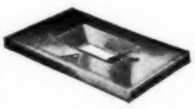
KNOBS

Cement coated—nail—genuine leather-washer—code standard. They don't chip when driven in and they stay in place.

● AN ILLINOIS Porcelain System enables you to do an outstanding modern wiring job—you are afforded every advantage in making easier, safer, more convenient, and efficient layouts — you can guarantee these porcelain systems for longest service life, for safety, and for greatest all round satisfaction. Porcelain does not rust or corrode. It is a logical wiring material because it conserves steel, zinc, copper, rubber. Grounding is unnecessary when you use this system. Clamps are not required for porcelain boxes. When you sell your next wiring, sell an ALL Porcelain System.

TOGGLE SWITCH PLATE

All porcelain with beveled edge and decorative pattern on face.



CLEATS

Standard one, two and three-wire types.

TRADE Bull Dog MARK REGISTERED

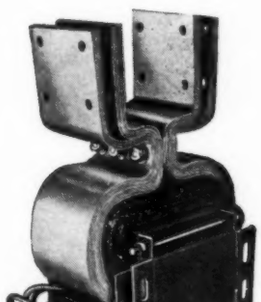
**ILLINOIS ELECTRIC PORCELAIN CO.**
MACOMB, ILLINOIS


EQUIPMENT NEWS

[FROM PAGE 92]

## Welding Transformer

This new welding transformer has been designed to perform specific operations in the production of war material. One of the features of this transformer is low secondary voltage and high current. It is for operation on primary circuits of 115 volt, single phase, 60 cycle and having secondary characteristics of 0.75 volt, 1600 amperes. The Acme Electric & Manufacturing Co., Cuba, New York.

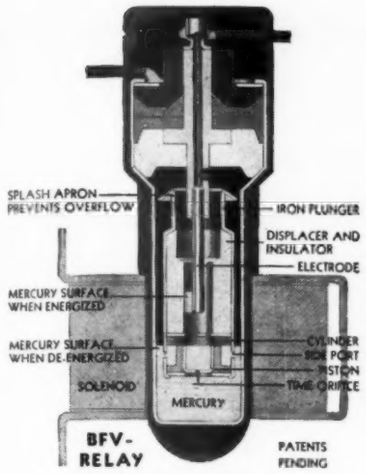


ACME WELDING TRANSFORMER

## Fluorescent Fixture

This new fluorescent fixture, known as the "Crawler", is designed for localized lighting in all types of production plants, where it is desirable to provide illumination on surfaces that cannot be properly lighted by overhead luminaires. It accommodates two and four 40-watt lamps and is equipped with either dust-tight or wire safety screen covers. Dust-tight covers are of non-breakable, clear plastic. Base is fitted with large free-rolling swivel casters for easy portability. Fixtures are furnished wired including sockets, starters, high power factor ballasts, toggle switch, cord and plug. Available for 110 or 220 volt, 60 cycle a.c. Day-Brite Lighting, Inc., 5405 Bulwer Ave., St. Louis, Mo.

DAY-BRITE FIXTURE




DURAKOOL RELAY

## Relays

The new Series BFV timers can be used in communication systems, machines, motors and electrical circuits where time intervals are required at beginning or at end of cycle. It delays its action upon closing of control circuit and, after such delay, closes main line circuit, and upon opening of control circuit the main line follows to an open position. The "B" model has a maximum of 30 amperes. These relays cool, quench and preserve contacts as they operate. Recommended where dust and dirt are present and in moist and explosive fumes. Capacity up to 75 amp. with solenoids wound to meet any voltage and frequency. Durakool, Inc., 1010 N. Main St., Elkhart, Ind.

■

G-E FLOODLIGHT

## Floodlight

The new L-43 floodlight is a bowed-in silvered-glass reflector. The shape of the reflector makes it possible for light to be reflected back to the parabolic surface, where it is redirected outward as part of the main beam. A standard 1,000 watt general service lamp is used with the unit. Floodlight is recommended for protective lighting, railroad lighting, general area lighting and lighting for construction work. It can be equipped with a metal visor for use in dim-out areas. General Electric Co., Schenectady, N. Y.


How to meet your transformer needs quickly and dependably

Select Newark TRANSFORMERS (Special and Standard Types)

For Control of Motor Speed

Suppose you had spent the last twenty years building transformers. Wouldn't you figure that you had the job licked, pretty thoroughly, too? Wouldn't you conclude that no new transformer problem could be a problem any longer than it took to turn your experience loose on it? That's our story.

We can build Newark dry type transformers to serve your needs, either in standard types or in special types using components of proven correctness. Capacities 1 to 75 kva. And—we may be able to deliver sooner than you expect. Check with us on this. Write for Bulletin A-10.

Do you need SUBCONTRACT help?

Call upon the facilities of our Subcontract Division, established long before Pearl Harbor. Floor space, machines, men available. Also the cooperation of a skilled engineering staff. Our record on this work demonstrates exceptional ingenuity in dealing with a wide variety of difficult manufacturing problems. Production time schedules always met, frequently bettered. Depend upon our production drive to get things *done*, and upon our 20 years of experience to get them done *right*. Our facilities may be just what you need. Phone or wire

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Newark TRANSFORMER CO.
17 FRELINGHUYSEN AVE.
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TRANSFORMERS FOR ALL PURPOSES

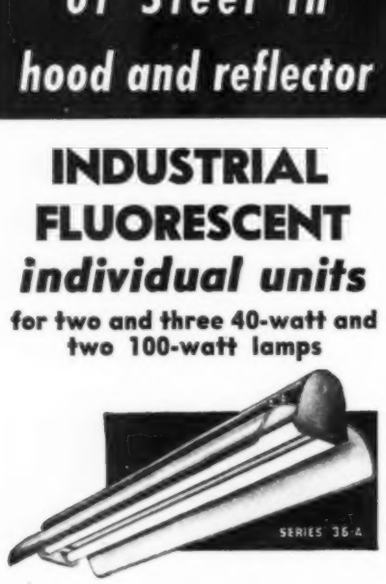
## It's Non-Metallic

Up-to-the minute in design
A seller for today
Durability for tomorrow

**Only Ounces of Steel in hood and reflector**

# INDUSTRIAL FLUORESCENT *individual units*

**for two and three 40-watt and two 100-watt lamps**




## *Designed for the War Industry*

**This new fixture development contains approximately 5% of the critical materials used in an all metal fixture and approximately 10% of the critical materials used in a fixture with a metal housing and non-metallic reflector; thus conserving the maximum of strategic materials for the war effort. It is fire resistant—water repellant—rugged and good appearing.**

**All fixtures are finished with our own "Klasium" enamel which is fire resistant and has a reflecting factor of approximately 86%. A finish proven by years of service.**

**Already this fixture is performing meritorius service for the Army and Navy under severe service conditions.**

**UNDERWRITERS LABORATORIES APPROVED**

***Write—wire or phone about this fixture today.***

**LIGHTING PRODUCTS, INC.**
**HIGHLAND PARK, ILLINOIS**


## EQUIPMENT *News*

[FROM PAGE 95]

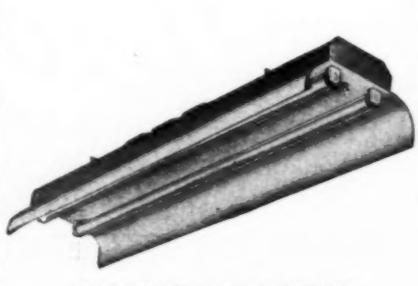
### Lugs

These Universal pressure type lugs are designed to accommodate conductors of various diameters, solid or stranded between the sizes of No. 14 to 2,000,000 CM. Eight adjustable lugs cover the full range of wire sizes. They are fitted with floating shield member that protects conductor against damage from binding screw. Both faces of lip parallel to each other. Available for one or two bolt holes. Krueger & Hudepohl, 232-8 Vine St., Cincinnati, Ohio.

K & H UNIVERSAL PRESSURE TYPE LUGS

### Fluorescent Reflector

This new fluorescent lighting fixture is called the "Dur-O-Lite." It is a non-metallic reflector and features the new "Insta-Lite," which gives instant starting and instant lighting with no starting switch. They are available for two 40-watt or 100-watt tubes and for three 40-watt tubes. Wiring and auxiliaries are mounted in steel raceway above reflector. Reflector is finished in white enamel with high reflection factor. The Spero Electric Corp., 18222 Lanken Ave., Cleveland, Ohio.



SPERO FLUORESCENT REFLECTOR


## To Help You Plan and Estimate Wiring Installations

# AUSTIN

**OFFERS**

**OUTLET BOXES**
**SWITCH BOXES**
**BAR HANGERS**
**LINE-O-LETS**
**BOX CONNECTORS**
**HEAVY WALL CONDUIT FITTINGS**
**THIN WALL CONDUIT FITTINGS**
**BUSHINGS AND LOCKNUTS**
**CONDUIT AND CABLE STRAPS**
**R E A FITTINGS**
**TOOLS**
**LUGS**
**NIPPLES**
**WIRES AND CABLES**
**ARMORED CABLE**
**THIN WALL CONDUIT**
**HEAVY WALL CONDUIT**

**These are just some of the items shown in our new 1942 144-page catalog. It is full of useful information and contains hundreds of illustrations that will be most helpful to you. Send for your copy today —ask for Catalog No. CF17.**

**THE M. B. AUSTIN COMPANY**
**110 S. DESPLAINES ST. CHICAGO**

## *This Sherman Lug Is Made to Handle the Heavy Loads*

**Here is a heavy duty wrought copper lug with the strength, weight and construction to do the hard jobs — handle big loads. Precision made, free from defects, with FLAT contact surfaces. For transformers, circuit breakers and other heavy duty electrical equipment.**

***Use Sherman***

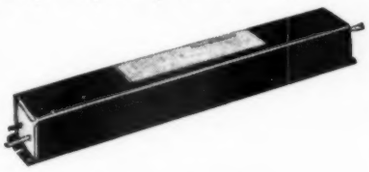
- **Solderless Connectors**
- **Ground Clamps**
- **Solderless Lugs**
- **Fixture Connectors**

**H. B. Sherman Mfg. Co.**
**Battle Creek, Mich.**

***Sherman*** **Heavy Duty Lugs**

## Lamp Ballast

A new model F 100-25 lamp ballast for four 100 watt fluorescent lamps is available for use in industrial plants. It is claimed that the ballast is designed to provide equalized and balanced secondary voltage to each lamp. Core and coil elements are impregnated and compounded to minimize normal resonant vibration. Acme Electric & Mfg. Co., Cuba, N. Y.



ACME LAMP BALLAST

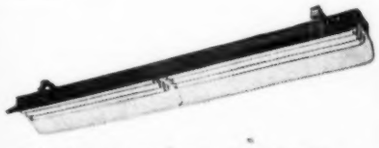
## Distribution Panelboard

A new unit distribution panelboard in drip-proof cabinet with shock-proof fuse clamps for marine applications is now available. It is for lighting, power, intercommunicating systems and radio. Panel is made of bakelite sections mounted on channel iron rails—service 2/2 wire 125 or 250 volt. It is available in 6 to 20 circuits. Solderless connectors are furnished in the mains. The Trumbull Electric Mfg. Co., Plainville, Conn.

TRUMBULL PANELBOARD

## Fluorescent Reflector

To conserve critical steel, eight new industrial fluorescent fixtures with composition reflectors have been announced. Fixtures range in size from 100 to 300 watts and are available for either individual or continuous-row mounting. Reflectors are finished in Miracoat baked white enamel, and outside of units in gray. The new adaptable slide-grip hangers are included with all continuous-row models. Model HFF-308P is shown and its overall length is 99⅜ in., width 13 11/16 in. and height 7⅞ in. It uses three 40 watt fluorescent lamps. Sylvania Electric Products, Inc., Ipswich, Mass.



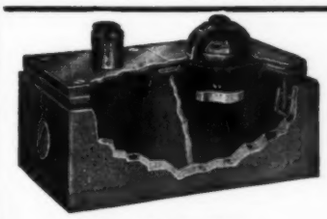
SYLVANIA FLOURESCENT FIXTURE


# LATROBE

## FLOOR BOXES *and* WIRING SPECIALTIES

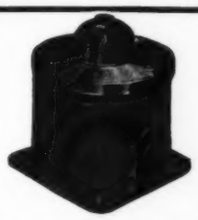
**"B&D" Cleat Attached to "Bull Dog" Support**

Cleat attachments consist of a cross bar with necessary bolts and screws for securing "B&D" Cleats to "Bull Dog" Insulator Supports.



**No. 252-R Two Gang Box**

Two gang adjustable floor box with No. 208 receptacle in one section. One cover plate with ½" flush brass plug and the other cover with 2" flush brass plug.



**No. 150 Box With No. 207 Nozzle**

An Underwriters' Approved box, suitable for installation in concrete floors or in wood finished concrete floors. Quickly and easily installed. Tops of boxes are easily adjusted.

FULLMAN MANUFACTURING CO. QUALITY AT LATROBE SUPREMACY LATROBE, PA.

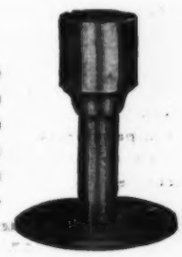
Check your stock today and let us know your requirements. We will make every effort to ship when wanted.

**Production Must Go On**

Latrobe time-saving, labor-saving specialties have been and are now a factor in keeping production constant in industries and projects throughout the country. Their ease of installation saves hours of precious time and their dependability makes them first choice for both temporary and permanent jobs.

**No. 280 Nozzle**

In No. 200 Cover Plate Ten Amp. 250 Volt receptacle in Brass Housing, mounted on ½ in. brass pipe extension 3 in. long. Furnished with longer pipe extension if desired.

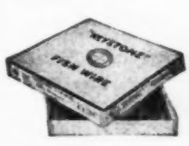


**No. 470 Pipe or Conduit Hanger**

Pipe support turns freely, allowing pipe to run parallel or at right angles to beam. Does away with drilling or use of straps. Handles ½", ¾" and 1" pipe to steel beams ⅜" thick.

**Keystone Fish Wire**

Made of finest grade flat steel wire properly tempered. Ten sizes. Packed 100, 150 and 200 foot coils. Other lengths if required.



FULLMAN MANUFACTURING CO.
LATROBE . . . PENNSYLVANIA

# In the News

## CODE COMMITTEE APPROVES NEW WARTIME RULES

The Emergency Committee of the Electrical Committee, NFPA, held its fourth meeting in New Haven, Conn., on October 15. The following action was taken.

The minutes of the meeting held on September 10, as circulated to the members, were approved as issued.

The definition of "continuous operation" as given in Interim Amendment No. 66 was revised in caption and text to read:

***Interim Amendment No. 66. Section 3004, 1940 National Electrical Code. Approved June 30, 1942, revised October 15, 1942.***

**"Operated continuously," as referred to in Interim Amendments Nos. 41 and 63, is operation where the conductors are loaded to the maximum permitted by Table 1, as amended, for a period exceeding three consecutive hours or six non-consecutive hours during any 24-hour period.**

### Type EI Insulation for Concealed Knob-and-Tube Work

Further consideration was given to the question of the recognition of Type EI insulated wires for ungrounded conductors in concealed knob-and-tube work. Chairman Small read a letter from Dean Harvey of the War Production Board commenting on the federal authorities' opinion on the use of this type of insulation in federal financed permanent housing. After a further discussion of the points involved, a motion to recognize Type EI insulation for concealed knob-and-tube work and concealed non-metallic sheathed cable, failed to receive a second.

### Switches for Welders

Interim Amendment No. 58, adopted at the September 10 meeting of the Emergency Committee calls for the use of motor-circuit type switches to control transformer-type arc welders without power factor correction. A question from the field asked how to select the proper size of motor-circuit switch for a welder rated in amperes or in kw, but not in horsepower. Secretary Tousley submitted the conversion table which follows. A general discussion of the current practice in rating welders followed and it was agreed that the table should apply to the "primary full-load current of the welder."

It was stated that in the case of a frozen electrode the current is approximately the same whether or not the welder has power-factor correction and that this so-called "short-circuit current" was somewhere around 172 per cent of the welder nameplate rating. No action was taken on this matter pending the expected report of the Technical Subcommittee on Welders.

It was agreed by the Emergency Committee that the table be included in the minutes of the meeting; that it be submitted to Chairman L. W. McCullough of the Technical Subcommittee on Welders; and that the table be released for discussion and further information.

| 220-Volt — Single Phase | | 440-Volt — Single Phase | | 550-Volt — Single Phase | |
|---|---|---|---|---|---|
| Ampere Rating Primary Circuit of Welder | Horsepower Rating of Motor Circuit Switch | Ampere Rating Primary Circuit of Welder | Horsepower Rating of Motor Circuit Switch | Ampere Rating Primary Circuit of Welder | Horsepower Rating of Motor Circuit Switch |
| 5.5 | 1 | 2.64 | 1 | 2.12 | 1 |
| 7.6 | 1½ | 3.70 | 1½ | 2.96 | 1½ |
| 10 | 2 | 5.50 | 2 | 3.98 | 2 |
| 14 | 3 | 7.18 | 3 | 5.74 | 3 |
| 23 | 5 | 11.4 | 5 | 9.3 | 5 |
| 34 | 7½ | 16.8 | 7½ | 13.4 | 7½ |
| 43 | 10 | 21.8 | 10 | 17.2 | 10 |
| 68 | 15 | 33.0 | 15 | 27.2 | 15 |
| 88 | 20 | 43.8 | 20 | 35.0 | 20 |
| 110 | 25 | 54.3 | 25 | 44.6 | 25 |
| 136 | 30 | 66.7 | 30 | 54.4 | 30 |
| 176 | 40 | 86.0 | 40 | 68.6 | 40 |
| 216 | 50 | 106.0 | 50 | 84.0 | 50 |

### Carrying Capacity of Weatherproof Wire

At its meeting on September 10 the committee considered a request from the War Production Board to increase the carrying capacity of weatherproof wire by 20 per cent over the ratings given in Table 2 of the 1940 National Electrical Code. In the discussion, the question of the possible dripping of the compound with this increased carrying capacity came up and Mr. Brandon of Underwriters' Laboratories was requested to investigate this feature.

Mr. Brandon reported that at 90 C drip did not occur, and submitted a table based on an operating temperature of 80 C but with the present values for conductors larger than 800,000 CM. The committee adopted, as an Interim Amendment, the following table which includes the 80 C operating temperature up to 800,000 CM and the 1940 National Electrical Code carrying capacities for larger sizes.

The committee adopted the following Interim Amendment as responsive to the WPB request.

***Interim Amendment No. 77. Table 2 (Page 302 of the 1940 National Electrical Code). Approved October 15, 1942.***

**Delete reference to Weatherproof Type WP wire from the last column of Table 2 and add a new column as follows:**

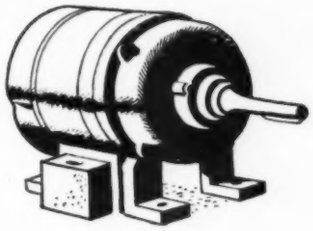
| AWG or MCM | Weatherproof Type WP |
|---|---|
| 14 | 30 |
| 12 | 39 |
| 10 | 54 |
| 8 | 71 |
| 6 | 98 |
| 5 | ... |
| 4 | 130 |
| 3 | 152 |
| 2 | 176 |
| 1 | 203 |
| 0 | 237 |
| 00 | 274 |
| 000 | 318 |
| 0000 | 368 |
| 250 | 410 |
| 300 | 460 |
| 350 | 508 |
| 400 | 554 |
| 500 | 629 |
| 600 | 709 |
| 700 | 779 |
| 750 | 811 |
| 800 | 845 |
| 900 | 930 |
| 1,000 | 1000 |
| 1,250 | .... |
| 1,500 | 1360 |
| 1,750 | ... |
| 2,000 | 1670 |

**Note. Nos. 14 to 8, solid. No. 6 and larger stranded.**

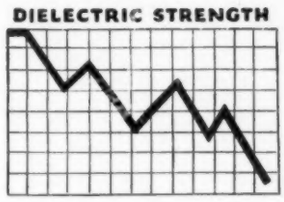
On motion, the action taken at the

*CONDUCT CABLE SCHOOL — J. Walter Collins (center) secretary, Electrical Contractors Association of City of Chicago, and instructors H. Hagg (left) and R. Avery of the Illinois Bell Telephone Co., kept a watchful eye on progress of electricians in a lead cable splicing school sponsored by the contractor association and Local B 134, I.B.E.W., Chicago.*

**1** ***Moisture can play hob around electrical equipment.***



**2** ***It can be absorbed into the insulation and lower its dielectric strength.***




**3** ***It can eventually result in all sorts of maintenance misery, as every engineer too well knows.***

**4** **BUT THERE'S A PRACTICAL SOLUTION TO THE MOISTURE PROBLEM!**

# It's an insulation of glass . . . plus varnish

The *fibers* in all Fiberglas* Electrical Insulations are glass.

That's why they do not absorb moisture and thus provide a better base for impregnation. As a result, the impregnated Fiberglas provides high resistance to destructive effects of moisture.

Similarly, most corrosive vapors do not attack this durable insulation for the simple reason that glass fibers are unaffected by oils and acids (except hydrofluoric).

Before the war, alert engineers were skillfully adapting Fiberglas to many kinds of equipment working under tough conditions. It gained wide acceptance as a superior electrical insulation.

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Many design engineers, now working with Fiberglas, are also looking ahead. They see how they will get outstanding performance with this glass material in all kinds of electrical equipment for future markets. They also know that Fiberglas gives them all the standard forms of electrical insulation to work with.

Perhaps, you would do well to consult your design engineers about the possibilities of using Fiberglas for critical war applications and in electrical equipment they are planning for the future. *Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.*

**FIBERGLAS***

*T.M. Reg. U.S. Pat. Off.

**ELECTRICAL INSULATION**

## In the News

[FROM PAGE 98]

Emergency Committee meeting on September 10 on high-voltage and high-current mercury-vapor lamps was reconsidered and the following Interim Amendment, No. 78, was approved.

***Interim Amendment No. 78, Section 4508, 1940 National Electrical Code. Approved October 15, 1942.***

**Add a new paragraph f to section 4508 to read:**

***f. Ballast for Lighting Units.*** **An auto-transformer may be used as a part of a ballast for lighting units provided the system supplying the auto-transformer is a grounded system.**

### Interpretation No. 229

Interpretation No. 229, on section 2105 of the 1940 National Electrical Code, as issued on August 4, 1942, came up for discussion as to the intent of the expression: "and do not have individual switch control," which appears in the last two lines.

The interpretation was revised on Oct. 15 to read as follows:

***Section 2105. Voltage to Ground. Interpretation No. 229. Issued August 4, 1942, revised October 15, 1942.***

**It was not the intent of the Electrical Committee that the expression "shall not exceed 150 volts to ground," which appears in the fourth line of section 2105 of the 1940 National Electrical Code, should be interpreted as applying to circuits supplying lighting only, in industrial establishments where the fixtures are not less than 8 feet from the floor and *do not have switch control as an integral part of the fixture.***

### Conductor Sizes—Cranes and Hoists

Chairman L. F. Adams of the Article 610 Committee reported progress in the determination of carrying capacities for cranes and hoists for conductor sizes above 4/0 as referred to in Interim Amendment No. 61.

### Conductor Insulations Types AVA, AVL, etc.

At the meeting of the Emergency Committee of September 10, a letter from the National Electrical Manufacturers Association was read which requested modification of the table on "Conductor Insulation" as reported by the Article 310 Committee. The representatives of NEMA were to report on this subject at this meeting of the Emergency Committee.

There appeared to be a question of whether the revisions proposed were directly concerned with the war emergency, and after some discussion it was voted to lay the matter on the table, to be taken up if the War Production Board indicates a need for some revision.

### Standards for Grounded Circuit Conductors

The representatives of NEMA stated they had no report to make at this time on the subject of standards for conductors to be used as the grounded circuit conductor.

### Conflict Between Interim Amendment No. 61 and Section 4312

The report of the Article 610 Committee, as published in the Article Committee Reports, included a recommendation to the Article 430 Committee to delete from the table in section 4312 references to "hoists" and "shop cranes." With the adoption of revised section 6112 as Interim Amendment No. 61, an apparent conflict in the Code was established. Chairman C. L. Kennedy of the Article 430 Committee had suggested the matter be referred to the Emergency Committee.

In the discussion there appeared to be a question as to what action was necessary. The matter was referred to the secretary to report at the next meeting of the Emergency Committee.

### Interim Amendment No. 70 on Article 670

In connection with Interim Amendment No. 70 which adopted new Article 670 on Machine Tools, a question had arisen as to the principle of section 4343-b where overcurrent devises used on one branch circuit must be of a type "approved for group installation."

Chairman Paul Ferneding of the Technical Subcommittee on Article 670, and a member of the Emergency Committee, called attention to paragraph c of section 6742 which requires "control equipment and running protective device" to be enclosed in compartments which conform to section 6732. The requirements of this latter section are designed to produce installations safe from a fire hazard when protected by one branch circuit overcurrent device.

It was deemed that no action of the Emergency Committee was necessary.

### Omitting Main Fuses

At the meeting of September 10, Messrs. Brand and McConnell were appointed as a special subcommittee to investigate the request of the War Production Board for consideration of a Code amendment to permit the omission of service fuses under certain conditions.

The subcommittee submitted a report which indicated that because of shortages in man-power, gasoline and tires, utility companies throughout the country were experiencing difficulties in replacing blown main fuses located in sealed service equipment enclosures. It was the thought of the War Production Board that in these instances (most of which involved installations made a number of years ago before the present meter sequence was recognized by the Code), where the branch circuit overcurrent devices were in close proximity to the service disconnecting means, the principles of present paragraph 2371-a-3 could be applied without great sacrifice of safety.

After detailed consideration the following Interim Amendment was approved.

***Interim Amendment No. 79. Section 2371, paragraph a-3, 1940 National Electrical Code. Approved October 15, 1942.***

**Add the following fine-print note to 2371-a-3.**

**For the duration of the war emergency, in existing installations that are provided with sealed overcurrent protection for the service conductors, feeder or branch-circuit overcurrent devices may serve in lieu of service overcurrent protection provided they are adjacent to or are located within the service equipment enclosure.**

Member Lynett is recorded as voting "no" on this item.

The failure of the committee on Articles 410 and 420 of the Code to present reports came before the Emergency Committee through action taken at the New Haven meeting of the Eastern Section IAEI, the lack of Code rules on fluorescent lighting having caused some inconvenience in applying the Code.

No definite action was taken by the Emergency Committee on this subject at this meeting of the committee.

Because of seeming limited interest in the matter, Chairman Small raised the question of whether a special committee of the Electrical Committee should be ap-

*NEW PRESIDENT — Max McGraw (left) president, McGraw Electric Co., Chicago, and newly elected president of the National Electrical Manufacturers Association, receives the gavel from his predecessor, George C. Thomas, Jr., president, The Thomas & Betts Co.*

*CONFERENCE CHAIRMAN, G. E. Hale, Chicago regional office, WPB, opens the second of a series of lighting conferences at the Chicago Lighting Institute, sponsored by the local WPB office.*

pointed to consider "the necessity or desirability for a separate article on control circuits and to recommend material for such a new article or such changes or additions to existing articles as are necessary or desirable" as proposed in the report of the Committee on Article 800.

The Emergency Committee voted that such a committee should be appointed.

### Interim Amendment No. 72

A letter from Chairman C. L. Kennedy of the Article 430 Committee discussing Interim Amendment No. 72, Section 4322, paragraphs a and b, approved at the September 10 meeting of the Emergency Committee, was presented to the committee. Copies of this letter will be mailed to all members of the Emergency Committee and the matter will come up at the next meeting of the committee.

### Carrying Capacity of Type SN Wires

Interim Amendment No. 46, approved May 7, 1942, recognizes Type SN wire "wherever types R, RP, or RH rubber insulated conductors are acceptable." The 1940 National Electrical Code recognizes Type SN conductors up to and including 4/0.

H. G. Knoderer stated there is a demand for this type of conductor above 4/0. Mr. Knoderer will submit information on the subject which will be considered at the next meeting of the Emergency Committee.

### Question on Interim Amendment No. 43 on New Section 3372

C. A. Ward, member of the Electrical Committee, asked the Emergency Committee for an interpretation of Interim Amendment No. 42 on section 3372, as it applied to a building project having a number of dwelling units consisting of single and multifamily units, sponsored by the Federal Housing Authority, and being constructed by a local housing board, under private contract, as a slum clearance or low cost housing project. This project was to be amortized on a sixty-year basis, but is now reclassified into a defense housing project for the duration of the war. At the termination of the war this project is to revert to

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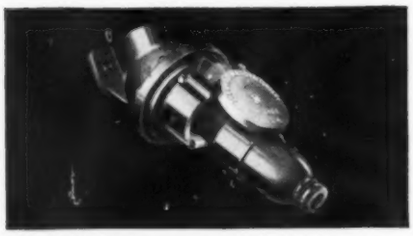

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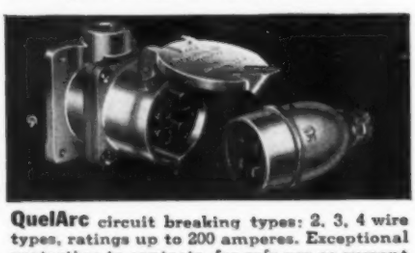

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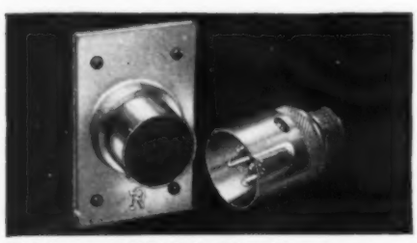

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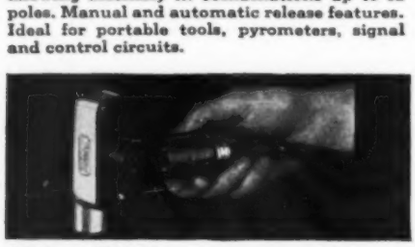

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## In the News

[FROM PAGE 101]

its original status as a slum clearance or low-cost housing project.

The questions raised in Mr. Ward's communication were answered by the committee. In the discussion that ensued, however, several points were raised in connection with the intent of section 3372 as approved by the Electrical Committee. The committee took action to give special consideration to section 3372 at the next meeting of the committee, with the possibility of removing certain restrictions and limitations.

There was some discussion on the intent of section 3882 of the Code as amended by Interim Amendment No. 59 but the committee took no action on the matter.

Member Brand presented to the committee a communication from the Wolverine State Electrical Association of Michigan on simplification of wire sizes. No action was taken by the committee.

Chairman Small presented a communication from the federal authorities suggesting the recognition of iron wire in control circuits in which the current values are low. The Emergency Committee took no action on this matter.

The date and place for the next meeting of the Emergency Committee was left open and will be subject to the call of the chairman.

### NEW DIM-OUT REGULATIONS

The new dim-out regulations for the Second Service Command which includes coastal New York, New Jersey and Delaware, have been issued by Major General T. A. Terry, Commanding General. These revised rules and regulations became effective on November 20, 1942 and supersede all regulations previously issued.

In the following, light and escape of light are distinguished from source of light which is defined as the bulb, or fluorescent or neon tube.

1. For the duration (unless amended) the regulations are effective from one-half hour after sundown until one-half hour before sunrise between Oct. 1 and April 30, and from one hour after sundown until one-half hour before sunrise between May 1 and September 30.

2. Any light, visible from out-of-doors that cannot be extinguished, obscured, or reduced in accordance with Standard War Department Blackout Specifications within 5 minutes after blackout signal, shall be permanently extinguished.

Do it electrically.

***IDEA MAN** in the motor repair department of the Briner Electric Co., St. Louis, Mo., is Ed Mueller, vice-president and shop superintendent. Since he started with the company in 1904, Ed has been solving his repair problems by designing and building his own equipment to suit the job.*

3. Any lights which cannot be shielded in such a way as to render them "not visible from sea" shall be extinguished.

4. All exterior lights used for outdoor manufacturing, in railroad yards, shipyards, necessary material handling, or any type of outdoor construction work shall be reduced in number and wattage to the minimum consistent with their purpose, and those retained in use shall be permanently shielded so that the source of light will not be visible at an angle less than 45 degrees below the horizontal. Street and traffic guidance light will be permanently shielded so that the source of light is not visible above the horizontal.

5. All exterior lights used for protective purposes, such as illumination of fence lines, exits, sides of buildings or open areas shall be shielded as in paragraph 4, and in no case shall the light as measured on the ground or other horizontal illuminated areas exceed one foot-candle at any point.

6. Interior lighting of buildings used for residential or commercial purposes or industrial establishments engaged in production of war materials (whether federally or privately owned or operated) shall be shielded either at the source of light or at the openings of the building in such a manner that the source of light shall not be directly visible from any point outside of the building.

7. All non-essential exterior illumination such as for parking lots, gasoline stations, playgrounds, places of amusement, open-air gardens and terraces, holiday decorations, and all other exterior lights not covered by other regulations herein, shall be permanently shielded so that the source of light shall not be visible at an angle less than 45 degrees below the horizontal. Such lighting shall be further limited as follows:

a. In no case shall the lighting as measured on the open area exceed one foot-candle at any point.

b. In no case shall the wattage exceed ¼ watt per square foot of lighted area for


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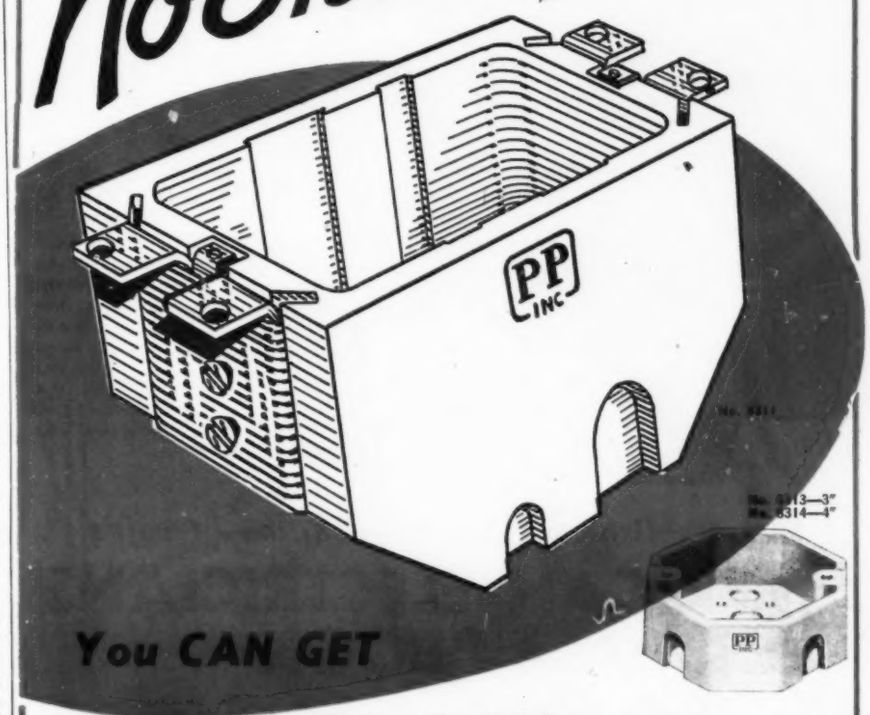


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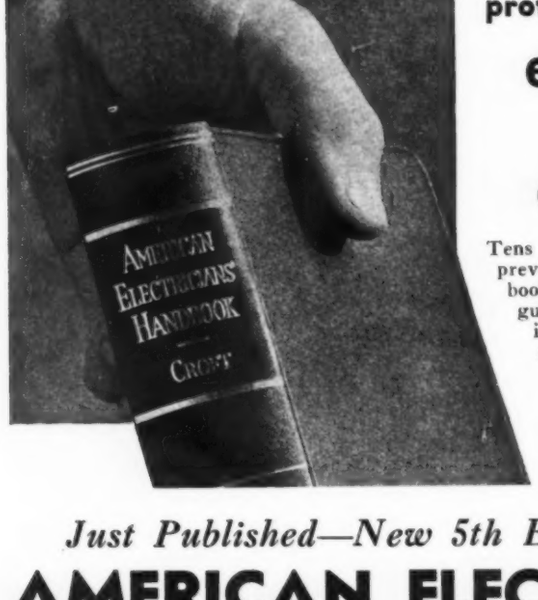


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## In the News

[FROM PAGE 103]

incandescent and ¼ watt per square foot for fluorescent.

8. All exterior advertising signs, however illuminated shall be extinguished.

9. Interior lighting of stores, show windows, commercial and industrial establishments (other than war production plants) shall be extinguished or shielded so that the source of light is not visible above the horizontal. It shall be further limited in that the escape of light from the building shall not exceed two foot-candles as measured by a photronic cell held at any point three feet from the window, door or opening of the building. Some suggestions have been issued with the order for complying with the above regulation:

a. Where the show window is separated from the main portion of the store, and lighted by incandescent bulbs which are shielded so that the source of light is not visible outside, the escape of light will not violate regulations if no more than ten watts per linear foot of window space is used or five watts per linear foot of window space if fluorescent light is used under the same conditions.

b. Where the interior of stores, restaurants, etc., are exposed to exterior view by large windows, a reduction to ½ watt per square foot of floor space is effective.

c. Where increased wattage is desired, fine mesh curtains or other types of effective filter may be used to limit the escape of light to the above specifications of two foot-candles at three feet distance from opening.

For further details on street car, bus, train, automobile and vehicle lights, open and out-door fires and exact boundaries of coastal dim-out area, see full text of the new regulation.

## NECA HEADQUARTERS MOVES TO WASHINGTON

On November 23d the headquarters offices of the National Electrical Contractors Association were moved to Washington.

According to an announcement by general manager L. W. Davis, the increasing need for closer contact and cooperation with the many Federal Government agencies whose activities directly concern the electrical contracting industry, has made this move essential for the fullest service to the Association's membership.

The new offices in Washington will be on the sixth floor of the Investment Building, 15th and K Sts., N.W.

## OUTDOOR CHRISTMAS LIGHTING

The War Production Board has asked city officials, civic clubs, chambers of commerce, merchants and citizens generally to

dispense with outdoor decorative lighting this Christmas.

WPB pointed out that Christmas lighting requires the use of critical materials, electricity, and manpower and is not in line with general conservation programs already under way.

The attitude of WPB toward Christmas lighting was announced because of numerous inquiries that have already been received from city officials, chambers of commerce and civic clubs asking what they should do this Christmas in regard to outdoor decorative lighting.

WPB is not asking that indoor Christmas lighting, whether in the home or in stores, be eliminated, but it believes that outdoor lighting, such as festooned store fronts and decorated streets, must be dispensed with in war time.

Although the electricity saving and the resultant fuel saving may appear small, as compared with the total annual usage, nevertheless the elimination of outdoor Christmas lighting is estimated to save 50,000,000 kilowatt hours of electricity, enough to meet the lighting and power requirements of a city of 50,000 for a year.

## PHILADELPHIA CONTRACTORS RESUME LECTURE COURSE

Enthusiasm of electrical contractors and their employees over the success of the Contractors Lecture Course for Electricians, conducted last year by the Electrical Association of Philadelphia, has led to the preparation of a similar course for the 1942-43 season. The first session was held Oct. 22.

This year's course on the theory and practice of electricity includes fourteen lectures, to be held from 8:00 P. M. to 10:00 P. M. each Thursday evening. Of nine lectures to be given by faculty members of the Moore School of Electrical Engineering, University of Pennsylvania, five will be given by Dr. S. Reid Warren, Jr.; three by Dr. Cornelius N. Weygandt, Jr.; and one by Dr. Arthur W. Burks. The remaining five lectures are scheduled to be presented by representatives of the

***PAST AND PRESENT** leaders of the Electric Association of Kansas City, chat at the group's 30th anniversary luncheon. F. M. Bernardin (left) was the organization's first president in 1912; Earl J. Goetze (right) occupies that chair now.*


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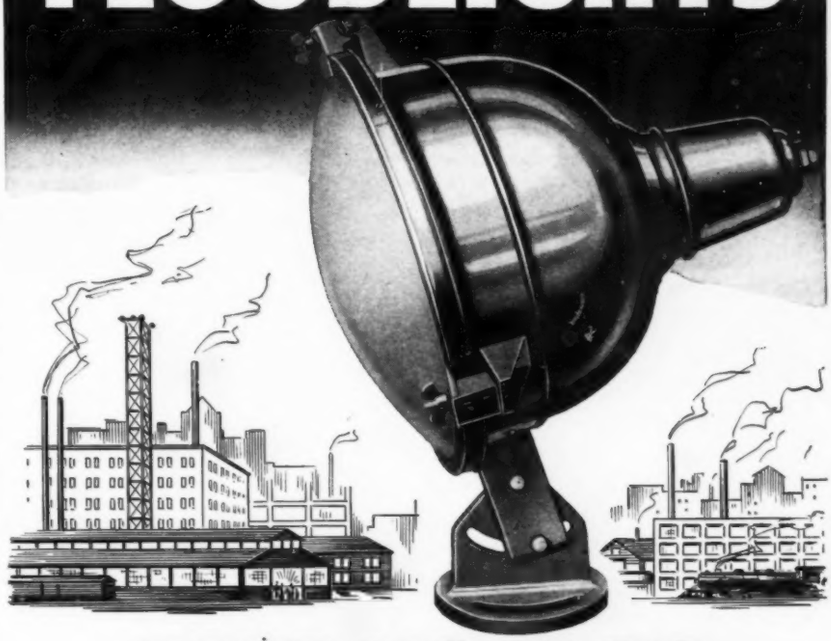

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If you can use more light—to increase production, to decrease spoilage, to reduce accidents—let our engineering department in Pittsburgh or our field representatives be of service to you. For general and localized lighting, directional lighting, auxiliary and spotlighting, Permaflectors provide inexpensive and highly efficient installations, employing a minimum of critical war materials.

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KONDU

## In the News

[FROM PAGE 105]

manufacturing or operating companies.

Based on a questionnaire sent to electricians who enrolled in last year's course, the Association prepared the following schedule of lectures:

Oct. 22—Introduction to Electricity and Magnetism

Oct. 29—Introduction to Electronics

Nov. 5—Direct Current Machines and D. C. Transmission

Nov. 12—Design and Application of D. C. Motors and Generators

Nov. 19—Introduction to A. C. Circuit Theory

Dec. 3—Power Factor and Vector Representation of A. C. Circuits

Dec. 10—Capacitors and Synchronizing Equipment for Power Factor Correction

Jan. 14—A. C. Transmission Lines; Short Circuit Protection

Jan. 21—Principles of Alternating Current Machinery

Jan. 28—Design and Application of Alternating Current Motors

Feb. 4—Operating Characteristics of Transformers

Feb. 11—Design and Operation of Transformers

Feb. 18—Elementary Problems in Telephony

Feb. 25—Design and Operation of Telephone Equipment

## MORE MATERIAL FOR WAR HOUSING

Allotment of 15,000 additional ingot tons of steel and companion materials to build approximately 20,000 units of war housing program already authorized by the National Housing Agency has been made by the War Production Board.

This action enables WPB field offices to resume processing applications for war housing projects in the approved program which comply with new requirements established by WPB and NHA. Today's allotment brings to 46,000 ingot tons the total amount of steel approved to date for war housing in the fourth quarter of 1942, providing for approximately 60,000 units.

All new projects must comply with the standards of design and materials consumption permitted by the "War Housing Construction Standards" which became effective October 28. In addition, privately built projects must comply with new regulations, approved by WPB and NHA, regarding the use to which they may be put. Privately built war housing also must meet rigid requirements permitting them to be rented by "War Workers." The definition of "war worker" is now being determined by WPB, NHA and the War Manpower Commission.

War housing projects are scheduled by NHA in the order of their urgency. Projects on the approved NHA program are

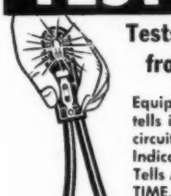

**Safe-T-Glow**

**HIGH TENSION DETECTOR**

SAFETY RULES call for that EXTRA precaution and additional RE-CHECK which SAFE-T-GLOW provides. Detects accidental tie-ins, crossovers, leakages and induced voltages . . . prevents serious injury and loss of life. SAFE-T-GLOW consists of a sensitive Neon tube, amplified by mirror reflector.

Model A for circuits 2,000 to 35,000 volts.
Model B for circuits from 35,000 to 220,000 volts.

**TEST-O-LITE**



**Tests Everything Electrical from 100 to 550 Volts**

Equipped with Neon light which tells instantly where trouble lies in circuits, fuses, cut-outs, motors, etc. Indicates hot or grounded wires. Tells AC from DC. SAVES PRECIOUS TIME. Has PATENTED safety features. Vest pocket size with clip. Lifetime guarantee. List Price $1.50 at leading jobbers.

L. S. BRACH Mfg. Corp.
55-63 Dickerson St. Newark, N. J.

**How to design, install and service fluorescent-lighting systems**

Examine Free

**FLUORESCENT LIGHTING MANUAL**

By C. L. Amick, General Electric Co.
312 pages, 217 illustrations, $3.00

A practical manual covering fluorescent lighting in all its aspects. Gives most authoritative information on construction and performance of all types of fluorescent lamps, principles and methods of calculating illumination needs and designing luminaires and installations, pointers and methods of installing and maintaining fluorescent lamps and of locating and remedying their troubles. Everything presented so anyone can understand it, with or without much electrical training.

MAIL COUPON

McGraw-Hill Book Co., 330 W. 42nd St., New York

Send me Amick—Fluorescent Lighting Manual for 10 days' examination on approval. In 10 days I will send you $3.00 plus few cents postage, or return book postpaid. (Postage paid on cash orders.)

Name .....
Address .....
City and State .....
Position .....
Company ..... FEC. 12-42

referred to WPB field offices for issuance of preference rating orders. Only those housing units recommended by NHA receive consideration by WPB.

## CONTRACT WHARF LIGHTING IN PITTSBURGH

Decision to award to the lowest bidder the City of Pittsburgh's electrical wiring contract on the City's $2,000,000 Duquesne Way wharf improvement has ended a long controversy between the city and two unions as to which might do the work—the utility company's independent union, or the A. F. of L. union.

Independent Ass'n. of Duquesne Light Co. Workers claimed the work under Duquesne Light Company's former contract with the City, which (contract) expired last January. Similarly, the A. F. of L. International Brotherhood of Electrical Workers claimed they should be allowed at least to bid on the work.

Pittsburgh City Council's move to ask for bids, according to the Council's spokesman, was made to obtain lower electric rates. Council claimed its Highland Park bridge having 75 lights had power lines constructed, wired and maintained by the County, cost $58,406 to install, and that in the 37 months following under the "W" rate of Duquesne Light Co. in force in that area the County saved $15,656 as against the amount it would have paid under the "S" rate in which Duquesne Light itself constructs the electric lines and appurtenances.

Since the new wharf improvement on which bids now are asked has an estimated 38 lights, roughly, the savings would be double the $15,656.

Under its former contract Duquesne Light Co. charged higher rates for equipping and wiring bridges, street sections, traffic lighting, because the utility set up the poles, transformers, junction boxes and other fixtures.

Another reason given for the higher

*FINISHING TOUCHES are applied to a branch circuit lead cable splice by Eugene F. Gardner, electrical maintenance department, Bowman Dairy Co., Chicago. Gene was a student in a recent lead cable splicing school conducted by the Electrical Contractors of City of Chicago and the I.B.E.W. Local B134.*

**Cold cathode lighting . . . operates most efficiently with Sola Transformers**

In war-production plants operating on a 'round-the-clock schedule, custom built, cold cathode lighting powered by Sola transformers provides an economical and practical method of plant lighting.

This "rugged" type of illumination is unaffected by shock and vibration and is ideal for use where precision production demands steady, shadowless illumination free of eyestrain and glare. It starts instantly without flickering and operates from 115V or 230V circuits.

The small amount of primary wiring required, the low maintenance cost and longer lamp life are important economy features to consider in these days of critical material shortages.

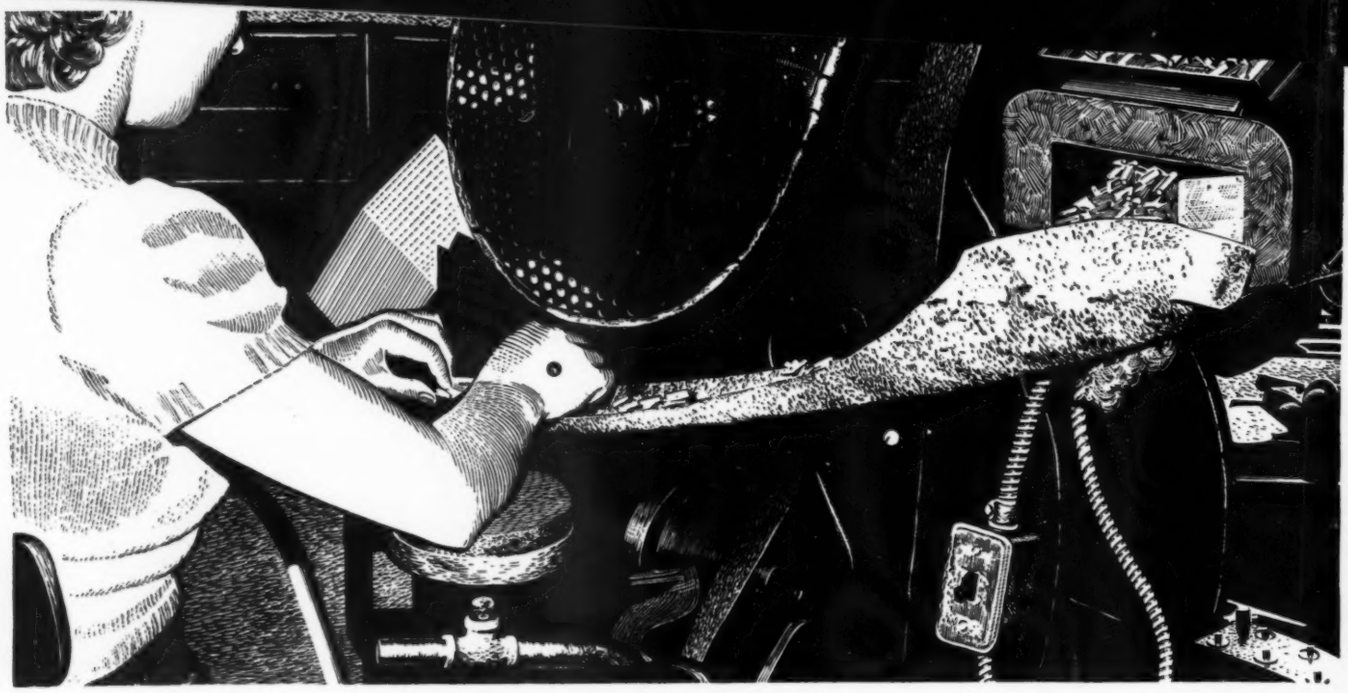
The famous Sola luminous tube transformers are now available for cold cathode lighting.

SOLA ELECTRIC CO.
2525 CLYBOURN AVE., CHICAGO, ILL.

*Write for Bulletin JLT-67*

COLD CATHODE LIGHTING TRANSFORMERS

SOLA



# How Sally used up a copper mine

LOOK at the picture carefully. See that elbow-rest under Sally's arm?

It is significant. In fact, it's a humble sermon on war production.

Understand the existence of that arm-rest and you understand one of the basic reasons why, in less than seven months after war-conversion, American industry is hollering for Washington to provide more copper and other basic raw materials.

► Before Sally got her arm-rest, she reached over to a box, picked up a tiny part for an airplane instrument and placed it in the machine . . . Now the supply box is tilted and constantly jiggled, so that the parts flow to her finger-tips. With each motion Sally saves a fraction of an ounce of energy and half a second of time.

Without such tiny savings of time and effort, America's 20,000,000 factory workers would be hopelessly handicapped in their race against the millions at work with a head-start of years in Germany, Japan and Italy.

► The muscle-misers and second-savers of our factories come in handy in this war, when splitting seconds in production is as important as it is in battle.

Who are the men that provide the arm-rests, jiggle the supply-boxes, conduct the ceaseless hunt for wasted half-seconds and needless human motion?

► They are the "methods" men of industry. They have all sorts of titles: plant managers, operations managers, methods engineers, efficiency engineers, etc. But their job is "to manage men and machines to save time and materials."

In peace, these men were the core of the industrial system that gave you the world's highest living standard at the world's lowest cost in hours of work.

► In war, these same "methods-managers," with the intelligent cooperation of American workmen, are cutting years from our arming task by splitting seconds from its millions of individual operations. This example of time-saving is just an indicator of what a plant operating man does. Such men have many other jobs, including the important job of plant maintenance, but "second-splitting" is the field in which they are the envy of the whole world.

The American Production Manager is the product of the American industrial system. Complex, loose-jointed and aimless though our system may seem to the theorist, it meets every challenge, because it is the best system ever devised by man for discovering, developing and rewarding individual initiative.

*Reprints of this advertisement are available in handy booklet form.*

*McGRAW-HILL PUBLISHING COMPANY, Inc.*

330 WEST 42ND STREET • • NEW YORK

# SALLY—

# IS UP YOUR ALLEY!

WASHINGTON, and other large city newspapers were used for the advertisement shown opposite, because government and public need to understand the asset which America has in its trained industrial staffs.

Read what we said about "methods management" in the advertisement, then ask yourself the secret of American genius for production economies in men, materials and time.

One big advantage we have in this country is the interchange of know-how between industries. If an instrument maker reduces a fourth-class hand motion to third-class, all other managers of small part assembly can, and do, find out how it was done.

By means of the articles and advertisements in FACTORY,* a plant operations magazine, tens of thousands of plant operating men keep abreast of each new development in equipment and technique.

The magazines of the McGraw-Hill Network of Industrial Communication exist solely for swapping ideas. They are backed by the editors and engineer-correspondents, who gather information wherever it is developed, and funnel it out to the fields where it is needed.

So valuable is this interchange of technical information that many companies are surveying their organizations to make sure that the supply of Industrial Magazines is adequate.

If you would like suggestions as to how to conduct such a survey, just write to Reading Counselor Department, McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York.

* * *

**THE McGRAW-HILL NETWORK**

23 publications, which gather "war-news" from the "war-production-front" through a staff of 153 editors and 725 engineer-correspondents... More than 1,500,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

**THE McGRAW-HILL BOOKS**

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

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330 WEST 42nd STREET • NEW YORK

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THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION:

*Factory Management & Maintenance—*SHOWS HOW TO MANAGE MEN AND MACHINES TO SAVE TIME AND MATERIALS*

American Machinist
Aviation
Bus Transportation
Business Week
Chemical & Metallurgical Engineering
Coal Age
Construction Methods
Electrical Contracting
Electrical Merchandising
Electrical West
Electrical World
Electronics
Engineering & Mining Journal
E. & M. J. Metal and Mineral Markets
Engineering News-Record
Food Industries
Mill Supplies
Power
Product Engineering
Textile World
Transit Journal
Wholesaler's Salesman

ALSO AFFILIATED WITH BUSINESS PUBLISHERS INTERNATIONAL CORPORATION, PUBLISHERS OF BUSINESS AND TECHNICAL MAGAZINES FOR OVERSEAS CIRCULATION

# Electric Welding and TIREX CABLES

Welding, as a process, is very old but with the advent of electric welding new fields of usefulness were opened up. Along with the rapid development and steady improvement of electric welders there have been equally interesting and important changes in the power and electrode cables used with them. Cables for such service must have flexibility, they must resist abrasion and they must be economical in operation.

Among the first TIREX rubber-sheathed cables designed for special work were TIREX Welding Cables having conductors made up of thousands of small copper wires to obtain flexibility (#4/0 has 5341), a tough rubber sheath for resistance to abrasion and with every promise of unusual serviceability. Performance records have repeatedly shown TIREX Welding Cables to be unexcelled in every way for the work they were designed to do.

TIREX rubber-sheathed Welding Cables are subject to War Production Board restrictions governing the use of copper and rubber but even with necessary modifications they still are suitable for the rough-and-tumble work of welding and can be depended upon for excellent performance. While they are not available for purely commercial uses they should be specified and used by industries on essential war work having high priority.

Simplex WIRES and CABLES

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.



# MEGOHMER

RELIABLE • ACCURATE • QUALITY

*Our modern insulation testers make insulation testing easy . . .* Entirely self-contained. Steady test potential of 500 volts DC, available at the touch of a switch. Direct reading in insulation resistance.

VARIOUS NEW MODELS AND RANGES
— WRITE FOR BULLETINS

HERMAN H. STICHT CO., INC.
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The Stone You Can Bend and Twist

Flex-Stone

DRESSES AND CLEANS ALL ELECTRICAL PARTS AND CONTACTS

What a job FLEXSTONE does! Cuts like an abrasive stone—but you can bend, twist it. *Won't break!* Thin, non-brittle. Sharpest abrasives are pressed into flexible core. Easily fits tight places. Smooths hardest contact points in relays, cutouts — cleans small commutators, switches, etc. Non-conductor — no short circuit. Rimac FLEXSTONE speeds electrical service. Send for *free sample!*

RINCK-McILWAINE, Inc., 16 Hudson St., New York, N. Y.


## In the News

[FROM PAGE 107]

Duquesne Light rate was that construction costs were not amortized over the years. Duquesne Light Co. may not bid on the new contract, according to the utility company representatives, because the company is not a contractor.

Decision to ask for bids was necessary because delay on the conduit installation was holding up the award of a $500,000 paving contract.

### MEET OUR INDUSTRIAL EDITOR

Robert E. Miller has joined the editorial staff of *Electrical Contracting* as Industrial Editor. In his new post he will help to serve the rapidly growing demands from our readers for experience data and information on industrial wiring design, methods, electrical equipment application and electrical maintenance.

Bob Miller will cover the East Coast and East Central areas contacting industrial electrical contractors, motor shops and industrial plants and enjoying the broadening influence of travel. His headquarters will be in New York.

*INDUSTRIAL EDITOR Bob Miller and stogie.*

Crammed with knowledge from Carnegie Tech and Michigan, Bob sallied forth into electrical construction and maintenance work in Pittsburgh and Bradford, Pa., learning the game under the guidance of several well calloused mechanics. He then moved into power system design and apparatus application work with a Pennsylvania utility sales department. With an urge to write and a strong conviction that the construction, installation and application branch of the electrical industry has a dominant destiny, Bob came to New York to join our staff. You'll be seeing him around.

## PITTSBURGH E. M. E. STARTS FALL MEETINGS

The first fall meeting of the Electrical Maintenance Engineers Association of Pittsburgh, led off the fall activities of the Electric League of Western Pennsylvania with a flying start. The discussions at the meeting centered around war production problems in our industries.

H. L. Huntley, maintenance supervisor, Westinghouse Electric and Manufacturing Co., in his subject "Calling All Horsepower" pointed out the necessity of disregarding normal peacetime practices with regard to motors and of taking advantage of "over-motored" reserve and favorable operating conditions in order to load each motor to the limit. A "find the facts" method of doing this was also presented. A plan of action to stimulate war plant production was discussed by W. W. Ring.

## PALMER HEADS C. E. A.

J. Paris Palmer, general manager, Cincinnati Branch, General Electric Co., was elected president of the Cincinnati Electrical Association at the annual meeting of that group Oct. 12. Other officers elected for the fiscal year of 1942-43 are: vice-president, H. E. Colliver, National Electrical Products Corp.; second vice-president, J. E. Schuster, Schuster Electric Co.; secretary, W. R. Keagy, The Cincinnati Gas & Electric Co.; treasurer, C. W. Johnson, Johnson Electric Supply Co.

## Priorities

### NEW CONTROLLED MATERIALS PLAN

Official copies of the pamphlet outlining the new Controlled Materials Plan are available for free and general distribution the War Production Board has announced. The CMP controls the flow of three basic and critical materials—steel, copper and aluminum—into war production. The plan goes into effect for some groups in the second quarter of 1943 and into full operation by July 1.

To explain fully to all interested persons the basic procedures of different phases of CMP, an extensive educational program is being organized by WPB. In connection with this program Mr. Nelson issued the following statement:

"The comprehensive nature of the Controlled Materials Plan makes it imperative that every government agency, plant, contractor and individual, directly or indirectly affected by it, fully understand it. For their guidance the War Production Board is organizing a comprehensive educational campaign designed to explain every phase of operational procedure.

"Among other things the War Production Board will establish in each of its


War Time Speed!

HERE'S ONE ANSWER—

KLEIN'S

● Serving telephone and telegraph lines carrying wartime messages—keeping power flowing to important industrial plants—helping speed freight and passengers on transportation systems—these are all jobs on which Klein tools are proving that under the strain of unusual conditions, quality counts.

Because war needs have first call on manufacturing facilities, owners of Klein tools and equipment are fortunate in possessing equipment that is designed to last longer because it is made better.

ASK YOUR SUPPLIER

Foreign Distributor: International Standard Electric Corp., New York

Mathias KLEIN & Sons

Established 1857

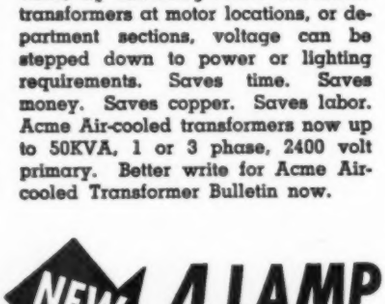
Chicago, Ill., U.S.A.

3200 BELMONT AVENUE, CHICAGO

# RE VOLTAGE DON'T REWIRE AND SAVE TIME AND MONEY

In lots of plants, rapid expansion has increased the power and lighting load dangerously close to the carrying capacity of the wiring system. But don't re-wire. Step up the incoming voltage from 220 to 440 or 440 to 600 and thus automatically increase the ampere capacity of the wiring system. Then, by installing Acme Air-cooled transformers at motor locations, or department sections, voltage can be stepped down to power or lighting requirements. Saves time. Saves money. Saves copper. Saves labor. Acme Air-cooled transformers now up to 50KVA, 1 or 3 phase, 2400 volt primary. Better write for Acme Air-cooled Transformer Bulletin now.

NEW 4 LAMP



## FLUORESCENT BALLAST

Those war production fluorescent fixtures with 4—100 watt lamps can now be operated with one ballast. This new Acme 4 lamp design provides balanced secondary voltage to 4—100 watt lamps and renders the same dependable performance that have made Acme Ballasts first choice in many important installations. For specifications, wiring diagrams, and operating features, write for Bulletin 157.

**THE ACME ELECTRIC & MFG. CO.**

36 Water St. Cuba, New York

Acme ACME Electric TRANSFORMERS


## In the News

[FROM PAGE 111]

offices a service and inquiry unit which will be equipped to answer all questions regarding procedure.

"Meanwhile, may I caution against jumping the gun on interpreting the specific part each participant is to play under the plan. Certain features of CMP are necessarily flexible and are subject to revision. Moreover, to maintain and constantly increase present levels of production, the transition to CMP must be orderly.

"We expect to have our service units in operation soon. May I ask indulgence while they are being formed and request that detailed questions be withheld until announcement of the completion of organization."

### MAINTENANCE GRANTED AA-1

Pointing up the importance of keeping the nation's civilian economy in a healthy condition, the Requirements Committee of the War Production Board has authorized a top priority rating of AA-1 for essential repair and maintenance.

Included in the scope of the determination, which becomes a basic policy for the first quarter of 1943, are essential repairs and maintenance for productive facilities, utilities, housing and consumers' durable goods.

The action will make it possible for vital plants and factories, mines and refineries and other industrial facilities to continue effective production of both munitions of war and essential civilian goods. Communication and transportation systems, gas, oil and water lines and other services will be assured of materials to keep them performing their essential functions. Supplies and materials needed for essential maintenance and repair for housing also may be obtained.

### CONSTRUCTION MACHINERY RESTRICTED

All construction machinery and equipment has been placed under allocations control by the Director General for Operations, with the issuance of Limitation Order L-192, stopping production for civilian use of certain types of equipment needed for the armed services. The restricted machinery will be manufactured hereafter only for use of the military or for civilian purchase.

Excavating and construction equipment and machinery of many descriptions is classified under three schedules which include such items as earth boring machines, portable engine or electric driven pumps of more than 90,000 gallons per hour, cable


FLUORAINE

**FLUORESCENTS BY MULTI**

FLUORITE

**REFLECTORS FOR GENERAL OR LOCALIZED LIGHTING . . . . . .**

MULTI Fluorescent Reflectors give you the modern method for taking care of industrial and residential installations. Our complete line contains the proper unit for any and all needs.

*Send for our complete catalog*

**MULTI**
ELECTRICAL MANUFACTURING CO.
1840 W. 14th ST., CHICAGO, ILL.

**ILSCO**
*Electrical Connectors*

**TWIN EFFICIENCY MULTIPLE CONNECTORS**

*LU4 for wires from 0 to 350,000 c.m.*

*LU6 for wires from 250,000 to 500,000 c.m.*

Sustained overloads have no terrors for this remarkably efficient connector. Ample contact area. Simple design. Installed neatly and quickly.

NO SPECIAL TOOLS REQUIRED. PURE COPPER OF HIGHEST CONDUCTIVITY.

MAIL THIS COUPON TODAY

Please send details and new 32-page illustrated catalog.

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**ILSCO** MARIEMONT, OHIO
COPPER TUBE & PRODUCTS, INC.

# How to save time by doing more reading

That is a profitable paradox for you. More true today than perhaps ever before. For here in the pages of this publication are packed many helpful ideas . . . considerable useful information. Much of it, in fact, available from no other source.

And we most emphatically mean *both* the editorial and the advertising pages.

Just one new idea gleaned from these pages . . . a method for doing something better or faster or easier or at lower cost, may alone save you far more than a year's reading-hours invested in this and other worthwhile business papers.

Many people have found this a fact . . . not only once, but time and time again. That's significant . . . with time so precious today.

★

*Good advertising speeds information from those who have it . . . to those who need it.*

★

**McGraw-Hill Publishing Company, Inc.**

330 West 42nd Street New York



# WHERE TO BUY

**Equipment, Materials and Supplies for Electrical Construction — Maintenance — Repairs**

**DRILLS CONCRETE—METAL—WOOD**

**WODACK "DO-ALL" ELECTRIC HAMMER AND DRILL**

Saves time and money installing expansion anchors. Drills concrete to 1⅜" dia.; metal to ⅜". Two tools in one. Easy to maintain. Universal motor. Write for folder.

Wodack Electric Tool Corporation
4628 W. Huron St. Chicago, Ill.
Telephone AUstin 9866

**"Jiffy" HOLE CUTTER**

Cuts round holes, quickly, easily and accurately in steel boxes.

*Write for circular.*

CLYDE W. LINT
102 So. Jefferson St. Chicago

**WILEY FLUORESCENT LIGHTING with Non-Metallic Reflectors**

***Instantaneous Starting Eliminates Starter Trouble***

New WILEY Fluorescent Fixtures can now be supplied with equipment for absolute starting. Lights come on fully at the turn of the switch.

WILEY Industrial Fluorescent Fixtures are made in all approved types for all applications, close-to-ceiling or suspended, continuous or separate units. Units are complete requiring no connecting boxes.

WILEY Fixtures now have non-metallic reflectors as required by WPB ruling. Reflection value is unchanged; same baked-enamel finish is used.

*Write for Booklet EC-122*

R. & W. WILEY, Inc. 777 Hertel Ave. Buffalo, N. Y.
Member Fleur-O-Lier Manufacturers' Ass'n.

**TORK**

*TURN ANYTHING ELECTRICAL ON & OFF REGULARLY*

The TORK CLOCK CO., Inc.
MOUNT VERNON, NEW YORK

***Stainless Steel Successfully Soldered***

Allen All-Sol Sodering Flux and stainless steel order give excellent and consistent results. Both "Extra Strong" and "Non-Dull" brands.

*Send for information*

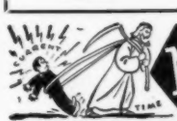
L. B. ALLEN CO., INC.
6715 Bryn Maur Ave., Chicago

**"FRIGID" VENTILATING EQUIPMENT**

Circulators, Exhaust Fans, Blowers, Attic and Industrial Fans, Spray Booth Fans, Shutters

*See your wholesaler*

Circulators and Devices Manufacturing Corp.
100 Prince St. New York, N. Y.

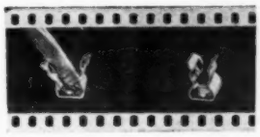



Transfer from normal to emergency service is *really instantaneous* with

**ZENITH IMPROVED AUTOMATIC TRANSFER SWITCH**

All contacts on one shaft, operate in same direction. *Electrically held.* No "off position" possible. A.C. to A.C., A.C. to D. C., any combination. 1, 2, 3, 4-pole types, 18 capacities. 30 to 400 amps. Send for Zenith Catalog.

**ZENITH ELECTRIC CO.**
845 S. Wabash Chicago, Ill.



Make this test: Actual movie photo of test. Note clip's return to perfect form

**LITTELFUSE BERYLLIUM COPPER FUSE CLIPS**

LITTELFUSE Beryllium Copper FUSE CLIPS show spring qualities equal to steel. Other characteristics: High fatigue resistance and tensile strength. *Grips fuses tighter.* Write for Bulletin.

LITTELFUSE INC., 4789 Ravenswood Ave. Chicago, Ill.

**What the**

**COMMUNICATIONS WORKER NEEDS**

***to know about electricity***

Radio men, telephone engineers, telegraphy technicians—all workers in the communication industry—here is a book written expressly for you. It gives you a clear, practical explanation of the fundamentals of electrical engineering *upon which communication is based.* All the explanations, all the illustrations, all the applications, are taken from the communication industry and not from the power industry.

*Just Out!*

**THE ELECTRICAL FUNDAMENTALS OF COMMUNICATION**

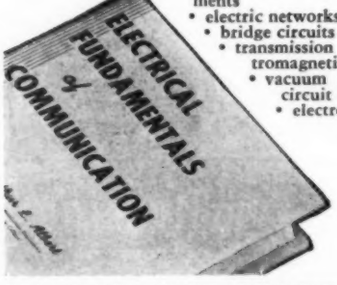
*By* ARTHUR L. ALBERT
Professor of Communication Engineering
Oregon State College
Professor of Electrical Engineering,
Purdue University (1942–1943)

*550 pages, 6x9, illustrated, $3.50*

This book presents the electrical fundamentals of communication, including the three divisions—telegraphy, telephony, and radio with its allied branches. It starts with electronics, explains what the communication technician wants to know about direct current, conductors, resistors, and insulators, discusses such topics as the magnetic field and inductance and the electric field and capacitance solely from the point of view of the communication industry.

Clearly, practically, it treats such topics as:

- electric measuring instruments
- electric networks
- bridge circuits
- transmission of electromagnetic waves
- vacuum tubes as circuit elements
- electroacoustics




**10 DAYS' FREE EXAMINATION**

McGraw-Hill Book Co., Inc.
330 West 42nd Street, New York

Send me Albert—Electrical Fundamentals of Communication for 10 days' examination on approval. In 10 days I will send $3.50 plus few cents postage or return book postpaid. (Postage paid on cash orders. Same return privilege.)

Name .....
Address .....
City & State .....
Position .....
Company .....EC. 12-42


## In the News

[FROM PAGE 112]

laying plows, winches, etc., and which have been arranged in accordance with the degree and nature of the controls and restrictions applied to the separate schedules.

By requiring registration of each unit of equipment, a control is maintained over the location and use of essential machinery. The purpose of registration is to enable prospective buyers, lessees, or other authorized users to negotiate for and obtain the equipment that has been released or which has become idle upon completion of the project to which it was allocated previously.

### NON-METALLIC REFLECTORS ORDERED TO SAVE STEEL

Substitution of non-metallic materials in the manufacture of reflectors for fluorescent lighting fixtures, as a means to conserve steel is required throughout the industry after October 31st.

Restrictions applied to reflectors are incorporated in a single amended order, Limitation Order L-78, issued October 19 by the director general for operations.

Changeover to the use of non-metallic substitutes, it is expected, will be accomplished with a minimum of inconvenience to the industry under a program developed through the efforts of the building materials branch in cooperation with the representatives of the industry.

Diversion to war use of fixtures and parts now "frozen" in the stock rooms of manufacturers under the "blocked inventory" regulation already in effect is also required by the amendment.

The order as amended authorized release of small inventories in the hand of retailers upon application to the WPB and approval by the director general for operations. Form 556, which can be obtained at any WPB field office, must be submitted by the retailer.

### TELEPHONES RESTRICTED NOVEMBER 17

Manufacture of telephone sets, except some of special combat design were stopped under the terms of Limitation Order L-204, by the director general for operations. The order limits manufacture of the sets to decreasing percentages for a 30-day period. For the first 15 days following issuance of the order, production is limited to four per cent of total factory sales value of telephone sets manufactured in the calendar year 1941. During the second 15-day period immediately following, production is limited to two per cent of the output for the same year.


**SEARCHLIGHT SECTION**
(Classified Advertising)

**Employment** **Business**
**Equipment**
(Used or Resale)
**"OPPORTUNITIES"**

UNDISPLAYED RATES

15 Cents a Word. Minimum Charge $3.00. POSITIONS WANTED (full or part time individual salaried employment only), ½ the above rates payable in advance.

BOX NUMBERS—Care of publication New York, Chicago or San Francisco offices count as 10 words. DISCOUNT OF 10% if full payment is made in advance for 4 consecutive insertions.

DISPLAYED RATE

INDIVIDUAL SPACES with border rules for prominent display of advertisements. The advertising rate is $7.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request. AN ADVERTISING INCH is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

NEW ADVERTISEMENTS received by December 18th will appear in the January issue, subject to limitations of space available.

**ELECTRICAL DESIGNERS**

If you are not now engaged in IMPORTANT WAR WORK we need your services.

**ELECTRICAL POWER APPLICATIONS ON steel plants**

Working a continuous cycle of one week of 44 hours followed by two weeks of 56 hours each; basis of compensation is hourly rate with time and a-half paid for work in excess of 40 hours per week.

Apply at once—giving complete details including hourly rate desired.

**ARTHUR G. McKEE & CO.**
2300 Chester Ave.
Cleveland, Ohio

WE BUY AND SELL
MOTORS
TRANSFORMERS
MOTOR GEN. SETS
OIL SWITCHES
AIR CIRCUIT BREAKERS
ELECTRIC EQUIPMENT CO.
675 Lake Ave., Rochester, N. Y.
Tel: Glenwood 6715

# Here is your *right* to buy

# —and here is the way to make it easier

You've just landed that big war order. It's a huge one . . . it will keep your plant humming for some time to come.

Your problem now is how to meet that deadline.

There are some changes necessary on your equipment. . . . Like explosion-proof motors, for instance. You know that the inflammability of the product you will manufacture will not permit the use of motors that spark.

You are familiar with several companies that make and sell motors. . . . But do they have motors for hazardous locations?

*Here's an easy answer.*

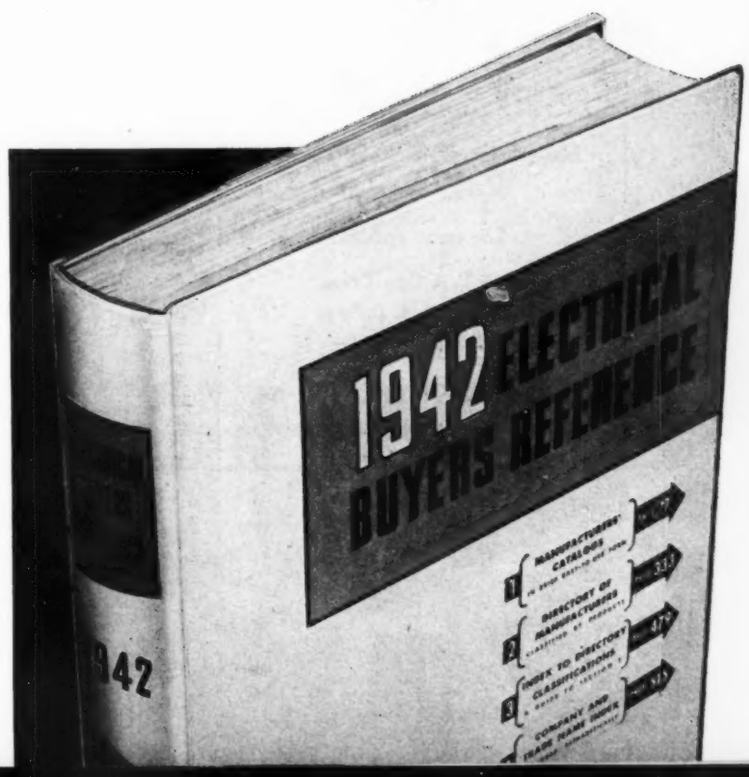
Reach for the *Electrical Buyers Reference*. . . . Turn to the heading "MOTORS" in the Directory Section. Under the twenty different motor classifications you quickly locate "Motors — Hazardous Locations." Six of the manufacturers are in bold face type, with a page number referring you to the BRIEFALOG* Section in the front of the book, where you find detailed catalog data giving the information you need to compare, specify and buy.

This is one of the many ways E-B-R can save you trouble.

Old timers habitually use E-B-R BRIEFALOGS for their buying and specifying of electrical products.

Newcomers in the field will find the BRIEFALOGS a speedy means of reaching a purchasing decision.

* Briefalog: The modern method of cataloging—with condensed descriptions and specifications on all products plus branch office, distributor and warehouse addresses for quick follow through.




## ELECTRICAL BUYERS REFERENCE

*A McGraw-Hill Service*

**330 WEST 42nd STREET NEW YORK**

**RELAYS**
**CONTACTORS**

**A NEW CATALOG FOLDER**
**on**
**A NEW LINE OF RELAYS**
**FOR INDUSTRIAL**
**and**
**GENERAL PURPOSE**
**APPLICATIONS**

Single, Double, and Multiple Pole
Alternating and Direct Current
7 to 400 Amperes Per Pole Capacity
Custom-Built Types to Specifications

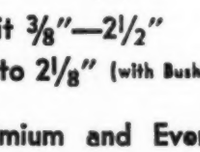
**AUTOMATIC**
**Electric Manufacturing Co.**
Mankato • Minnesota



**MINERALLAC HANGER**

Conduit 3/8"—2 1/2"
Cable to 2 1/8" (with Bushings)

Cadmium and Everdur
**MINERALLAC JIFFY CLIP**



Sizes from .250" O.D. Tubing to 1 1/4" conduit.

*See your Jobber*

New York City Office
Theodore B. Daily
50 Church Street

**MINERALLAC ELECTRIC CO.**
25 N. Peoria St., CHICAGO



# *NOW*... REPRINTS OF
# CODE WAR RULES
## *are available for your entire organization!*

The important diagram analysis of the War Code Supplement that appeared in November Electrical Contracting—plus the analysis of the Machine Tool Code rules in this issue—are now available in reprint form on coated paper—bound together. These articles can be of immeasurable help to everyone in your organization who is concerned with electrical specification and installation. *Contractors* need them for executives, foremen, workmen. *Manufacturers* should distribute them to their engineering staffs, sales organizations and customers.

A limited supply is being reprinted. Please place your order *now*.

## THIS OFFER GOOD UNTIL
# JANUARY 1st
*USE THIS COUPON TO ORDER*

ELECTRICAL CONTRACTING
330 W. 42 St., New York

Please send me ..... copies of your 8 page reprint "Code War Rules"

Name .....

Address .....

INDIVIDUAL COPIES 10¢

10-50 COPIES 8¢

LOWER PRICES ON LARGER QUANTITIES

*REMITTANCE MUST ACCOMPANY ORDER*

## WITH THE Manufacturers

### G-E Appointments

K. R. Van Tassel has been appointed manager sales of the newly formed Integral-horsepower Motor Section of the General Electric Company's Motor Division. D. A. Yates, of the same division, has been placed in charge of the Lynn Motor Group at G-E's Lynn, Mass., plant.

J. L. Townsend has been appointed assistant manager sales, Fractional-horsepower Motor Section.

R. H. Luebbe has been appointed assistant manager of G-E's Appliance & Merchandise Department, Bridgeport, Conn.

•

### Westinghouse Changes

Russell L. Whitney has been appointed sales manager of the Westinghouse Electric & Manufacturing Company's Transformer Division. A. C. Farmer, formerly assistant sales manager, has been named assistant to the vice-president.

Westinghouse Lamp Division has opened a new district office in Philadelphia. This new Middle Atlantic District is managed by Harry A. Croasdale, formerly assistant manager of the Middle Western District and at one time branch manager in Philadelphia. R. A. Corvey, Philadelphia branch manager, has been appointed assistant manager of the Northeastern district with headquarters in New York City.

•

**Sylvania Electric Products, Inc.,** has appointed Don G. Mitchell as vice-president in charge of sales. This is a new office, established to plan and direct the distribution and merchandising of all Sylvania products.

•

**The Crocker-Wheeler Elec. Mfg. Co.,** Ampere, N. J., has announced the release of C. F. Poirier, vice-president to the War Production Board for an indefinite period. Mr. Poirier will serve in the capacity of Electrical Consultant to the Shipbuilding Division.

•

**The Standard Transformer Company,** Warren, Ohio, announces the appointment of The John W. Clarke Company, 327 South LaSalle Street, as its Chicago representatives.

•

**Eicor, Inc.,** of Chicago, Ill., are moving to new headquarters at 1501 W. Congress Street.

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★ **These companies have included Briefalogs, containing additional buying information on their products, in the 1942 edition of the Electrical Buyers' Reference.**

## Maintaining Industrial Control

[FROM PAGE 29]

raising the exciting current. This applies only to a.c. contactor or solenoid coils.

If the circuit voltage is more than 110 per cent of the rated voltage of the coil, a coil specially wound for the voltage should be used. Most manufacturers can furnish coils that are wound, for instance, for 250 volts for use on a nominally 220 volt circuit on which the voltage may actually be in the neighborhood of 245 volts.

Any one of several methods can be used to test a coil for shorted turns, but the description of these methods is beyond the scope of this article. The substitution of a new coil known to be in good condition is usually the easiest method when spare coils are carried in stock. This procedure not only verifies or excludes the hypothesis that the coil is at fault, but in cases where it is at fault it also gets rid of the trouble in one and the same operation. The remedy for (c) is obvious, and (d) is usually caused by binding or misalignment or the accumulation of dust or smut on the pole faces. Noise usually accompanies these conditions in a.c. contactors or solenoids.

### Open Coils

If failure of a contactor to close is thought to be due to an open in the operating coil, it is well to test for opens with a fairly high wattage lamp or by connecting a duplicate coil in series with the suspected coil and measuring the voltage drop across the two coils. If this method is used with a.c. coils, both coils should be removed from their iron cores and only about one-quarter of motor voltage applied to the two in series. The use of a high-impedance testing device such as a voltmeter or neon lamp in series with the coil may give a misleading indication. This is because the charring which usually occurs when an open develops in a winding may have sufficiently low leakage resistance to permit enough current to flow to cause a large deflection on a voltmeter or a bright glow in a neon lamp.

**3.**—*Excessive Vibration*

Excessive vibration may cause loosening of contacts, breaking of metal parts because of fatigue, short circuits and, if particularly severe, may even cause a general falling apart of the whole control. Obviously the possible remedies fall into three broad divisions; namely:

(1) Remove the control to another place where it will not be affected by the vibration.

(2) Isolate the control by means of a properly designed resilient mounting, or

(3) Eliminate the vibration at its source either by eliminating the exciting force or detuning any part of the structure which may happen to be at or near resonance.

The simple expedient of adding to the mass of the resonant portion of the structure may reduce the vibration to a harmless amount. However, the use of hit or miss methods for schemes (2) and (3) may make matters worse rather than better, and the help of someone well versed in the theory of vibration and its elimination may have to be enlisted.

**4.**—*Improper Use by Operators Causing Damage or Excessive Wear*

Most maintenance men could tell of cases in which operators of machines and equipment have failed to give due consideration to the proper care of intricate or even simple devices. Control equipment, some of which must of necessity be rather delicate in construction, often shares the fate of fine instruments and precision machinery in being carelessly handled. Aside from pure carelessness, however, there may often be fine points of technique in operation that can be taught to maintenance crews and operators in order to lengthen the life of the equipment. The mention of two very simple examples must suffice here.

### Tickling the Switch

It is surprising how many experienced electrical men will "tickle" the common knife switch when shooting trouble or when they fear that there may be a short in the circuit. The false thinking that gives rise to this action is that a momentary contact of the switch will cause a pronounced arc if there is a short present, but that they can then reopen the switch before the current builds up to a dangerous value, whereas if the switch were closed all the way, a greater length of time would be required to open it. This second point is of course true but the first one is not, since the resistance of contact of the switch is usually a very small percentage of the total resistance or impedance in the circuit, even when a short circuit exists. As a result, an excessive amount of current flows immediately and damages the edges of the blades and clips.

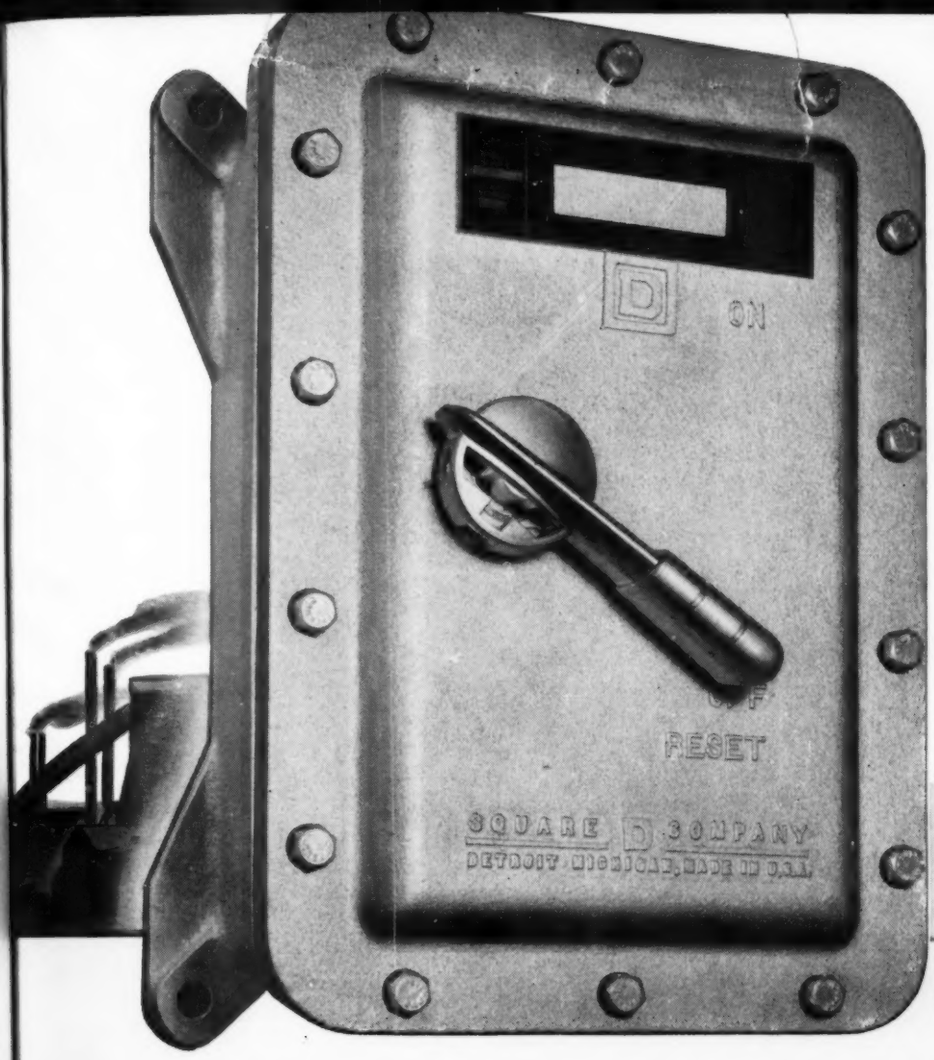
Other methods of determining the condition of the circuit should be resorted to, if possible, before closing the switch, but in cases where this is not possible, the fuses should be removed and a trial closing of the switch made, to make sure that the blades and clips are properly lined. The fuses should then be installed and the switch closed with a firm, quick motion. This will cause the flash, if any, to occur in the barrels of the fuses rather than at the edges of the clips and blades, on which globules of copper may be formed that will destroy their alignment or reduce the pressure between them, thus causing overheating on future loads. Aside from this is the more important consideration of the danger of burning the operator's hand.

The manual starter for direct-current motors furnishes our second illustration. Almost invariably, the starting procedure is to close the line switch, bring the handle of the starter slowly up to the first contact segment, and then move more or less rapidly to the running contact. This results in burning of the leading edge of the first contact. This can be avoided by bringing the handle to the first segment and holding it there while the knife switch is closed, after which the handle should be moved to the running contact only as fast as the acceleration of the motor will permit without giving rise to excessive current peaks on the intermediate segments.

### In Conclusion

These may be viewed as trivial instances of the importance of good operating technique, but it is hoped that they will stimulate thinking on the part of maintenance men so that other instances will come to mind of equipment in their own plants that could be kept in service longer if handled with a little more consideration. Anything that will prevent an hour's shutdown or that will lengthen the life of the equipment even a small amount is worth careful consideration since every hour counts in the battle of production.

**SEE PAGE 117 FOR ADVERTISERS' INDEX**



**Industrial Multi-breaker**—2 or 3 pole, 15 to 100 amp., common trip, quick make and quick break.

# MULTI-BREAKERS FOR *Hazardous* LOCATIONS

Square D has broadened its line of cast explosion-proof Multi-breakers—in pace with current wartime requirements.

In shell loading, powder, processing and synthetic rubber plants—wherever explosion and fire hazards exist, these Multi-breakers afford low cost circuit breaker protection.

All Class I, Group D enclosures are tested individually at 450 pounds hydrostatic pressure—an added assurance of their strength and stamina on the job. The line also includes enclosures for Class II, Group G locations.

**Multi-breaker Load Centers** 1 to 8 single poles or up to 4 single poles and 2 double poles, 15 to 50 amp., 125/250 volt.

**Multi-breaker Load Center** 1 to 4 circuits, 2 pole, no neutral, common trip, 15 to 50 amperes, 115/230 volts, A.C.

**CALL IN A SQUARE D MAN**

SQUARE D COMPANY

DETROIT - MILWAUKEE - LOS ANGELES

KOLLSMAN INSTRUMENT DIVISION, ELMHURST, NEW YORK

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

SCHOOL OF MINES
LIBRARY
RAPID CITY S D

*From the Atlantic to the Pacific*

# G-E WIRING MATERIALS DISTRIBUTORS

## Are Eager to Co-operate in Aiding the War Effort

G. E. White, sales manager, Central Electric Supply Company, Battle Creek Mich., G-E distributor, among other services, helps local plant engineers and maintenance men to keep their wiring systems in first class condition by supplying materials and helpful service as needed.

G-E Wiring Materials Distributors offer a wide variety of conduits, boxes and fittings, wire and cables and wiring devices for war work. Included are materials for wiring system maintenance . . . for wiring system conversion . . . for new wiring. One of these distributors is located near you assuring convenient contacts and friendly service.

Talk with a representative of this G-E Wiring Materials Distributor about your wiring problems. You'll find his knowledge of new developments and methods helpful. He'll be glad to make wiring suggestions . . . to help plan wiring . . . to help select materials . . . to follow delivery schedules personally.

Behind G-E Wiring Materials Distributors stands the General Electric Company recognized everywhere for the quality of its products. Continual research keeps G-E materials up-to-date. Therefore the materials handled by G-E Wiring Materials Distributors are sure to meet your wartime needs.

J. A. Ackerman (right), A-B Electric Supply Co., Morristown, N. J., G-E distributor, is here helping W. G. Nordling of C. P. Dean, Inc., Summit, N. J. select suitable wiring materials for an important rush job.

The G-E wiring materials field force is divided into geographical districts in order to provide greater help for distributors and their customers. Here is J. O. Wetherbie, manager of district No. 2. His headquarters are in New York, N. Y.

Three generations of Cahn's are active in the Cahn Electric Co., Shreveport, La., served by the Shreveport General Electric Supply Corporation. Cahn Electric has done war work in excess of $1,000,000 the first nine months of 1942, finishing on schedule or before, and using G-E wiring materials. Seated in photograph: A. S. Cahn (left), partner and Carroll Cahn, father of the Cahn brothers. Standing, left to right: D. B. Young, salesman, General Electric Supply Corporation, Shreveport; G. A. Burton, auditor and expeditor; J. G. Harriss, supt. and chief estimator; A. S. Cahn, Jr., 3rd generation; H. E. Cahn, partner.

### SEE YOUR G-E DISTRIBUTOR

The nearest G-E Wiring Materials Distributor will be glad to give you information about G-E conduits, wires and cables and wiring devices suitable for your particular needs. General Electric Co., Appliance and Merchandise Dept., Bridgeport, Conn.

GENERAL ELECTRIC